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HOW EFFECTIVE HAS THE AIR FORCE BEEN IN ELIMINATING ITS DEPENDENCE ON OZONE DEPLETING CHEMICALS?

THESIS

L. Susan Willard, GS-12

AFIT/GCM/LAS/94S-8

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THESIS

Presented to the Faculty of the Graduate School of Logistics and Acquisition Management of the Air Force Institute of Technology

Air University

In Partial Fulfillment of the

Requirements for the Degree of

Master of Science in Contracting Management

L. Susan Willard, B.S.

GS-12

September 1994

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Preface

The purpose of this study was to assess the Air Force's initiatives to eliminate its dependence on Ozone Depleting Chemicals. The Montreal Protocol, as well as other laws, policies and directives, decreed that, due to the damaging impact of Ozone Depleting Chemicals, production of the chemicals cease as of certain specified dates. Air Force acquisition programs depend on ODCs to varying degrees as either end products or through a variety of processes. This research project determined the extent to which ODCs were relied upon and assessed the progress which had been made to eliminate that dependence. Variables which were affecting full implementation were identified so that future management attention can be applied.

This research project would not have been possible without the assistance of several individuals. I am especially grateful to the sponsor of this thesis, Brigadier General Timothy Malishenko, Director of Contracting, Air Force Material Command. BGen Malishenko's interest in, and support of this project, added significant value to the effort. I also wish to thank my advisors, LtC Michael Heberling and Dr. Charles Bleckman, for their wisdom, guidance, patience, and encouragement. Special thanks goes to Major Richard McDonough, HQ AFMC/PKP, for his willingness to share his insights of the Ozone Depleting Chemicals situation. I am also indebted to all the Program Directors and their staffs who took time out of their busy schedules to participate in the survey. Final thanks goes to my family for their continued support and understanding throughout the last fifteen months.

L. Susan Willard

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Abstract

This research was undertaken to determine how effectively the Air Force had eliminated its dependence on Ozone Depleting Chemicals. The research was limited to analyzing the impact of ODCs on major acquisition programs. Results indicated existing variables which may be impeding full implementation. Also identified were lessons learned which could be applied to future environmental legislation with potential impact on acquisition programs. In-depth telephonic interviews were conducted with Program Directors responsible for the development and fielding of major Air Force acquisition programs. Analysis revealed that ODCs substantially impacted the acquisition programs to the extent that many programs had classified their reliance on the chemicals as "Mission Critical". Although great strides had been made in the private sector to identify alternatives to ODCs, Program Directors, in many cases and for numerous reasons, had not made the substitutions on their programs. Program Directors have diligently been applying resources to solve their specific ODC problems, but unless greater cross-flow of information and cooperation among Air Force programs, DoD organizations, and the private sector takes place, progress will be impacted. Future environmental legislation could be more effectively implemented by the development and implementation of an overall coordinated, strategic approach.

HOW EFFECTIVE HAS THE AIR FORCE BEEN IN ELIMINATING ITS DEPENDENCE ON OZONE DEPLETING CHEMICALS?

I. Introduction

General Issue

During the past twenty years, our country has experienced an increased emphasis on protecting the environment. As a result, legislation addressing environmental issues has increased dramatically and has had an impact at the national, state, and local levels. Not only have private citizens and business entities been affected by this legislation, but the federal government (and in particular the defense acquisition workforce), has had to modify its way of doing business as well.

The most recent legislation to impact the Department of Defense (DoD) was included in the FY 93 National Defense Authorization Act (NDAA), Title III, Section 326 (Public Law 102-484)(United States Congress, 1993). This act set forth the requirements for DoD compliance in eliminating Ozone Depleting Chemicals (ODCs) from military procurements. Under the new law, the level of ODCs utilized by the military is to be reduced, with the eventual goal of total elimination. As of 1 June 1993, new DoD contracts cannot require the use of particular ODCs unless approved by the senior acquisition official. The ODC prohibition also effects existing contracts in excess of $10,000,000 that have award dates prior to 1 June 1993 and which will be modified, amended, or the period of performance extended more than one year after the effective date of the change.

The elimination of ODCs has been a topic of national discussion for a number of years, yet as of 1 June 1993 (effective date of NDAA), the Air Force was not fully prepared to comply. Policy and procedures were in draft format, waiver procedures were nonexistent, and the acquisition workforce had not been trained. The acquisition workforce, struggling to do an already complex job with diminished resources, was now expected to comply with an ill-defined requirement.

The ODC law has had, and will continue to have, significant impact to the Air Force acquisition community. What initiatives must the Air Force take to ensure compliance with the immediate requirement of reducing the level of ODCs? What long term measures must be introduced to comply with total elimination of the damaging chemicals while assuring a systematic and economical withdrawal?

Background

The Clean Air Act Amendment of 1990 added Title VI which addresses stratospheric ozone depletion and global warming. This Title replaced and strengthened previous amendments to the Clean Air Act dealing with the same issue. Title VI established a program for the phase out of ODCs in accordance with the requirements of the Montreal Protocol (an international agreement for the phase out of ODC)(Stensvaag, 1991: 25).

As required by Congress, EPA established an initial list of Class I substances which include Chloroflurocarbons (CFC), Halons, Carbon Tetrachloride, and Methyl Chloroform and Class II substances (Hydrochloroflurocarbons)(a complete list of the Class I ODCs is contained in Appendix A). The law stipulates that beginning in 1991, it is unlawful for any

person to produce any Class I substance in an annual quantity greater than various percentages set forth in the statute. Beginning in 2000 (2002 for Methyl Chloroform), all production of Class I substances is prohibited. With the exception of medical devices, the use and production of Class II substances must be phased out by 2030.

On 11 February 1992, President Bush unilaterally accelerated the phase out of domestic production of ozone depleting chemicals (Class I) from the year 2000 to 1995 and called on other nations to follow his lead. The President challenged U.S. producers to reduce production of these substances to 50 percent of the 1986 levels by the end of 1992. In his statement, the President noted that due in large part to the use of innovative, market-based mechanisms such as production fees and tradable allowances, the U.S. had already reduced CFC production 42 percent below 1986 levels, a reduction that was beyond that required by either the Clean Air Act or the amended Montreal Protocol (Lemonick, 1992: 62).

In support of the President's proclamation, the Under Secretary of Defense (Don Yockey) issued a memorandum to the secretaries of all military departments on 11 August 1992 which established policy for the DoD. It specifically required the military departments to do the following: 1) give priority attention to revising specifications and requirements to eliminate the use of ODCs and where possible, modify existing contracts to incorporate the new specifications and requirements; 2) reevaluate all operational and training uses of ODCs and be proactive in evaluating, approving, and using substitutes; 3) required approval of the Component Senior Acquisition Executive when using ODCs in new systems or modifications to existing systems; 4) required the Defense Logistics Agency (DLA) to establish and manage a Defense reserve of

ODCs to ensure availability of supplies for "mission-critical" uses (Under Secretary of Defense, 1992).

Under the tenants of NDAA, approval may be granted to include a specification or standard that requires the use of a class I ODC only if it is determined that a suitable substitute for the Class I ODC is not currently available. For existing contracts with award dates prior to 1 June 1993 with a value in excess of $10 million, the contract must be evaluated to determine if it includes a specification or standard that requires the use of a Class I ODC or can only be met through the use of such a substance. The deadline for completing this evaluation is within 60 days after the modification or extension is issued and until such determinations are made, no further changes can be made to the contract. In the event that the determination is affirmative, it must next be determined whether the contract can be carried out through the use of an economically feasible ODC substitute or through alternative technology. The law requires this determination to be made on those existing contracts that are modified or extended if the period of performance is one year or greater and it extends the original contract by more than one day. If it is determined that an economically feasible substitute or alternative technology is available, the Contracting Officer is charged with modifying the contract, and adjusting the price if appropriate, to require the use of the substitute substance or alternative technology.

On 7 January 1993, the Secretary of the Air Force (Donald Rice) and Chief of Staff (General Merrill McPeak) jointly issued a memorandum containing the Air Force policy on ODCs (Secretary of the Air Force, 1993). The Air Force policy was issued to implement the NDAA and Under Secretary of Defense for Acquisition (USDA) policy issued on 11 August 1992 but actually

was more restrictive. The Air Force policy, in addition to addressing the purchase of items requiring the "use" of ODCs, also addresses the purchase of ODC in bulk (e.g. any amount of freon). The Air Force policy also added Halon 1011 and 1202, and Methyl Bromide to the list of 20 chemicals listed in Section 602 of the Clean Air Act. Three offices at the air staff level were established as the only waiver approval authorities for the Air Force (SAF/AQ, AF/CE, and AF/LG).

Advance copies of Air Force Acquisition Circular (AFAC) 92-29 dated 21 May 1993 were distributed on 27 May 1993; HQ AFMC/PK Interim Policy was distributed on 15 June 1993; interim ODC waiver application and approval procedures was issued by HQ USAF/CVA on 14 July 1993. All releases had an effective date of 1 June 1993 (up to 45 days prior to their actual release) (Department of the Air Force, 1993).

Specific Problem Statement

By definition and design, military weapon systems are not "environmentally friendly". "It may seem a contradiction to think of weapon systems as environmentally sound. Weapons are supposed to be harmful at the receiving end" (Williams, 1989: 4). In the past, the environment has only been given minor consideration in the acquisition process, with major emphasis on performance, schedule and cost. This practice is changing now as we enter an era where the environment is taking precedence over economic factors and

pollution prevention is in vogue rather than the practice of the historical "end-of-the-pipe" treatment methods.

> The perception of many in Congress is that federal facilities in general, and the Department of Defense (DoD) facilities in particular, lag behind the private sector in complying with environmental laws. The Secretary of Defense (Dick Cheney) has indicated that his department will set the standards for environmental compliance for the nation. (Armentrout, 1991:20)

Secretary Cheney went on to say, "Defense and the environment is not an either/or proposition. To choose between them is impossible in this real world of serious defense threats and genuine environmental concerns" (Grimes, 1991: 81).

The Secretary's proclamation is commendable, but are the defense departments aware of and ready to apply the resources necessary to make the drastic changes? In particular, is the Air Force really prepared to support the reduction and elimination of ODCs from major systems, and have the appropriate mechanisms been put into place to facilitate this substantial change?

Research Objective and Investigative Questions

The purpose of this research is to examine the extent of compliance with legislation within the Air Force acquisition community, and potential variables that may affect successful implementation. To achieve this goal, the following investigative questions were developed:

1. To what extent were Air Force acquisition systems dependent upon ODCs?

2. To what extent have Program Directors been provided with information on the ODC situation, and tools and knowledge required to reduce/eliminate ODCs from their programs?

3. To what extent had alternate technologies or products been identified as economical replacements for ODCs and to what extent had substitutions been made?

4. To what extent had ODCs been eliminated from Air Force Acquisition Programs, including technical documents?

5. Had Program Directors benefited from cooperative efforts taking place within the DoD, Federal Government, and private sector?

6. If Program Directors had determined that ODCs contributed to a critical mission need, what was their long term plan for acquiring the chemicals?

7. What data collection methodologies had Program Directors been using to project future requirements for ODCs?

Scope and Limitations

This research project will be limited to an examination of the impact of the ODC legislation on the acquisition of major defense acquisition programs. Various major defense acquisition program offices within Air Force Material Command will serve as the data collection organizations. It is not the intent of this research project to examine the operational use of ODCs (for example, fire fighting units), and determine how well replacement and elimination of these uses is proceeding.

Ideally the results of this research project will provide insight into how well the Air Force acquisition community is proceeding with the requirements to

reduce/eliminate use of ODCs and identify activities where additional resources (personnel, technology, research and development) might need to be applied.

Definitions

The following key terms are defined and used throughout this report:

1. Ozone Depleting Chemical (ODC): Chemicals listed in Section 602 of the Clean Air Act Amendment. They are considered harmful to the ozone layer. Ozone Depleting Substance (ODS) is used interchangeably with ODC.

2. Ozone Depletion Potential Factor: A factor established by the EPA Administrator to reflect the substance's Ozone Depleting potential on a mass per kilogram basis, as compared to CFC-11. The factor is based on the substance's atmospheric lifetime, the molecular weight of Bromine and Chlorine, the substance's ability to be photolytically disassociated, and upon other factors determined to be an accurate measure of the relative Ozone Depleting potential (Stensvaag, 1991: 15-16).

3. Major Defense Acquisition Program: An acquisition program that is designated or estimated by the Under Secretary of Defense for Acquisition to require:

(a) an eventual total expenditure for research, development, test and evaluation (RDT&E) of more than $200 million in FY80 constant dollars (approximately $300 million in FY90 constant dollars), or

(b) an eventual total expenditure for procurement of more than $1 billion in FY80 constant dollars (approximately $1.8 billion in FY90 constant dollars)(Department of Defense, 1991).

4. Major System: A combination of elements that will function together to produce the capabilities required to fulfill a mission need, including hardware,

equipment, software, or any combination thereof. A system that is estimated by the Under Secretary of Defense for Acquisition to require:

(a) an eventual total expenditure for RDT&E of more than $75 million in FY80 constant dollars (approximately $115 million in FY90 constant dollars), or

(b) an eventual total expenditure for procurement of more than $300 million in FY80 constant dollars (approximately $540 million in FY90 constant dollars)(Department of Defense, 1991).

Summary

This chapter has described the general issues, background, research problem, research objectives, investigative questions, scope and limitations, and key terminology appropriate to this thesis effort. The next chapter will examine literature which describes the concerns with the ozone layer, the evolution of the international agreements, industry initiatives, and the status of the DoD with regards to compliance with the ODC law. Chapter Three will describe the methodology followed to collect data, Chapter Four will include the analysis of collected data, and Chapter Five will draw conclusions and suggest additional topics for research.

II. Literature Review

Introduction

The previous chapter presented a broad overview of the Ozone Depleting Chemical (ODC) situation and the issues that the Air Force faces while trying to comply with the ODC laws and regulations. This chapter will present a more detailed history of the ODC issue, discuss why we should be concerned with the ozone layer, document the evolution of international agreements and domestic law, present the initiatives industry has undertaken and the problems that they have encountered, and finally, present the status of ODC issues within the Department of Defense.

Background

Environmental concerns and regulations addressing those concerns are not new to Americans. During the last several decades, we have witnessed an exponential growth of laws, regulations, and policies, along with the formation of enforcing agencies to address environmental concerns.

During the prosperous time of rapid industrial expansion during the 1950s and 1960s, little thought was given to the side effects of industrialization, particularly environmental pollution. By the late 1960s, however, Americans had come to realize that with unrestrained industrialization came negative consequences. This awareness resulted in strong demands for regulation of industry.

The energy crisis that occurred in the early 1970s contributed to a stagnation of the world economy, decreased economic growth within the United States, and high rates of inflation. Industry took the position that excessive

government regulations and controls affected their ability to be innovative and productive. In response to pressures from industry, and in an attempt to stimulate the economy and encourage investment activity, Government actions during the late 1970s and early 1980s were characterized as supportive of deregulation. It was not until the late 1980's that increasing concerns over global warming and ozone depletion lead to tighter controls and a renewed pressure for Government regulation (Rothwell, 1992: 447).

Defense issues have also played a role in the refocus to environmental issues. With the end of the Cold War and the perceived decreased threat to our national defense, more resources and emphasis have been placed on other potential threats. In a survey conducted by the Roosevelt Center for American Policy Studies, Americans were asked to rank the potential threats to U.S. security. Parker reported that global environmental problems were ranked the highest, followed by the spread of nuclear and chemical weapons, and domestic social concerns (Parker, 1990: 21). This sentiment was echoed by Senator Sam Nunn (D-GA) who was quoted as saying, "Environmental deterioration in a very real sense threatens our national security and the security of the world." (Grimes, 1991: 9).

The United States is not alone in its realization of, and emphasis on, environmental issues. The industrialized nations of Western Europe, Canada, and Japan join the United States in annually spending two to three percent of their gross domestic product on environmental issues and clean-up (Grimes, 1991: 11).

One of the greatest issues to capture environmental concern is that of ozone depletion. Although not a new phenomena, recent evidence indicated that the ozone layer is being depleted at an alarming rate. The Environmental

Protection Agency reported that the ozone layer over the U.S. had thinned by 5 percent over the last decade (Miles, 1992:22).

As early as 1974, scientific evidence linked a group of chemicals called Chloroflurocarbons (CFC) as the primary contributors to ozone depletion. At that time, several nations banned the use of CFCs as aerosol propellants thinking that this would solve the ozone depletion problem. But the ban was limited to only a few nations and only affected aerosols; the use of CFCs in other applications was not discouraged. Since industry was under the assumption that the ban on aerosol propellants would solve the ozone problem, they did little research and development on substitutes for CFCs. In fact, because of their relative stability, low toxicity, availability, and relative low cost, CFC use spread to the refrigeration, foam, and electronics industries. By the mid 1980's, use of CFCs was back up to mid-1970 levels (Seidel and Blank, 1990: 301-304). It was not until the ozone hole over Antarctica was discovered and confirmed in 1985, that many of the world's governments realized the severity of the ozone depletion problem.

Ozone Layer

Why should we be concerned with the disappearance of the ozone layer? The ozone layer is a part of the stratosphere one and a half miles above the earth's surface; it serves to filter out harmful ultraviolet radiation. Without the protective ozone layer scientists fear people will be more vulnerable to skin cancer, increased incidence of cataracts, and suppression of the immune system. Damage to crops and aquatic organisms, as well as increased formation of ground-level ozone leading to an increase in smog levels are also

potential side effects. In addition, ozone depletion has been linked as a culprit to global warming, another tremendous worldwide environmental problem.

Scientists believe that the chlorine molecules, which make the CFCs so stable in the lower atmosphere, are released in the stratosphere and act as catalysts by repeatedly combining with and breaking apart ozone molecules. This reaction depletes the ozone layer and allows more ultraviolet radiation to penetrate the earth's surface (US GAO, 1991:3). Another initially desirable characteristic of CFCs, long atmospheric lifetime, unfortunately also contributes to the potential to damage the ozone layer. Given an immediate ban on CFCs, atmospheric chlorine concentrations will continue to increase for another ten years because of the lag time from when the CFCs are manufactured until the time they reach the stratosphere. Even as concentrations of CFCs begin to decrease, it will take decades for levels to fall below those at which ozone destruction was first observed (Zurer, 1992:10).

Legislative History

The United States has not been alone in practicing pollution control versus pollution prevention during the past decades. Many industrialized nations of the world have taken the same approach to protecting the environment - clean it up afterwards rather than protect it during the process. So when in the mid 1980's, the ozone hole was discovered and confirmed over Antarctica, there was immediate consensus among the world leaders that this problem was not to be blamed on any one country nor could it be solved by any one country. This was an environmental problem that had global implications and would take a tremendous joint effort to control and solve.

Global discussions ensued and on 16 September 1987, the United States, along with 23 other nations and the European Economic Community, signed the historical agreement known as the "Montreal Protocol on Substances That Deplete the Ozone Layer" with an effective date of 1 January 1989. This monumental agreement was known as "the unifying force to bring nations together to formulate a plan of action to identify the severity of the actual environmental problem and develop a strategy to prevent further ozone depletion and return to pre-CFC atmospheric conditions" (Senecal, 1992: 182).

The Montreal Protocol, as it is commonly referred to, set forth an agreement and timetable for reducing the production and consumption of specific ODCs. As it was written, the Montreal Protocol avoided the problems of selecting individual uses to control, establishing emission limits per individual uses, and monitoring and enforcing those uses. Instead, it required manufacturers to freeze the production and consumption levels of the five CFCs at 1986 levels beginning in July 1989 with phased in reductions of at least 50 percent by July 1998. Beginning in February 1992, production and consumption of the three Halons were to be frozen at their 1986 levels.

After further scientific evidence showed greater than expected stratospheric ozone depletion, the parties met again in London in June of 1990. Given the severity of the problem, the parties agreed to strengthen the original provisions of the Montreal Protocol and to accelerate the phase-out of CFC production, with the exception of Halon. In addition, other ODCs were added to the list of affected chemicals; these included Methyl Chloroform, Carbon Tetrachloride, and ten other fully halogenated CFCs. These changes to the

Montreal Protocol, known as the "London Amendments", specifically required that:

- manufacturers reduce CFC production by 50 percent of the 1986 levels not later than 1995, 85 percent by 1997;

- the production and consumption of CFCs, Halons, and Carbon Tetrachloride be eliminated by 2000;

- Methyl Chloroform be eliminated by 2005;

- HCFCs be eliminated by 2040 (EPA, 1993: 15014).

On the domestic front, scientists, environmentalists, and politicians, recognized that ozone depletion was due to manmade causes and thought that more could be done to protect the earth's ozone layer. Their concerns culminated in the signing of the Clean Air Act (CAA) Amendments of 1990 by President Bush on 15 November 1990. In effect, the amendments added Title VI to the Clean Air Act and required a more stringent interim phase-out schedule of ODCs than the Montreal Protocol. CFC production was to be totally eliminated by 1999 and Halon by 2000. The CAA Amendment also affected other ODCs and mandated a faster phase-out of Methyl Chloroform from 2005 to 2002; it restricted the use of Hydrochlorofluorocarbons (HCFCs) after 2015, and banned total production of HCFCs after 2030. In addition to changing the phase-out schedules, the CAA Amendment divided ODCs into two Classes and listed Class I substances as CFCs, Halons, Carbon Tetrachloride; and Methyl Chloroform, and the HCFCs as Class II substances.

As the designated administrator of the CAA, the EPA was required by the amendment to further encourage the reduction of emissions of Class I and II substances to their lowest achievable levels (lower than levels specified in the law, if possible); to maximize the use of recycling and recovery technology; to ban nonessential products containing ODCs; to mandate that warning labels

be placed on products made with or containing Class I or II substances; and to establish a safe alternative program. Some of these requirements have been fulfilled, others are still in process. As an example, the labeling requirements are in effect and products manufactured with ODCs must bear a label that reads "WARNING: Contains (insert name of chemical), a substance which harms public health and the environment by destroying ozone in the upper atmosphere" (Stensvaag, 1991: 56). In contrast, the safe alternative program is still in the formative stages.

Despite all international actions, additional evidence again surfaced that proved ozone depletion over the last decade was more severe than had previously been predicted. NASA released findings in October of 1991 that showed a trend in ozone depletion over the U.S. to be greatest in summertime - when risks from ultraviolet radiation were the greatest (EPA, 1993: 4768).

On 11 February 1992, partially in response to the NASA findings, President Bush announced yet another accelerated phase-out schedule for the Class I substances. He also ordered an accelerated review of the EPA's safe alternatives program.

At a meeting of the Parties to the Montreal Protocol in Copenhagen, Denmark in November of 1992, parties again proposed adjusting the phase-out schedules and chemicals covered by international agreement. The "Copenhagen Amendment" took effect on 1 January 1994 and had the following impact: an acceleration to the interim phase-out schedule of CFCs with a complete phase-out by 1996; a complete phase-out of Halons by 1994; an accelerated interim phase-out of Carbon Tetrachloride with a complete phase-out in 1996; an accelerated interim reduction of Methyl Chloroform with complete phase-out in 1996; interim phase-out on the consumption of HCFCs

and a complete phase-out by 2030. Two new chemicals, Hydrobromo-fluorocarbons (HBFCs) and Methyl Bromide, have also been proposed for addition to the list of controlled substances with a complete phase-out of the former substance by 1996 and a freeze of the latter substance starting in 1995 at 1991 levels (EPA, 1993: 15014).

The changes in the Copenhagen amendment are consistent with an EPA Proposed Rule published in the Federal Register on 18 March 1993 (EPA, 1993: 15014). EPA's proposed rule goes further though and calls for a ban on specified trade between the U.S. and foreign states not party to the Montreal Protocol. Driving the accelerated phase-out are several petitions and sets of comments received from environmental organizations and industry groups.

As illustrated by the multiple revisions and refinements that have taken place since the original Montreal Protocol was signed, the associated parties are serious about confronting the ozone depletion problem and are committing their nations to serious, defined steps to return the stratosphere to its original form. Currently, 92 foreign states and the U.S., representing greater than 90 percent of the world's consumers of CFCs and Halons are party to the Montreal Protocol with many of these 92 countries also ratifying and accepting the amendments to the original protocol (EPA, 1993: 15014).

ODC Tax

The Montreal Protocol, as amended, and CAA, as amended, are not the only formal provisions to influence the phasing out of the production and consumption of ODCs. Congress felt that from an economic standpoint, ODC users would be more motivated to comply with and accelerate the ODC phase-out schedules if an excise tax were imposed on the sale and use of ODCs. As

of 1 January 1990, the ODC excise tax went into effect to "create a market incentive to reduce production and consumption of ODCs and to encourage the development of environmentally safe alternatives" (Pearson and Schmidt, 1991:257). The tax applied to any ODC sold or used by the manufacturer, producer, or importer of the chemical.

Opponents of the tax felt that the tax would be cutting into industry's research and development funds thereby preventing industry from developing alternative materials and processes. Another concern was that the tax would make it difficult for U.S. companies to maintain their lead on developing alternatives since no other country had imposed a tax on its domestic production or consumption levels (Zurer, 1989:7).

Those backing the tax felt that it would be easily administered, economically efficient, and supportive of developmental efforts for substitutes by causing the price of ODCs to increase, discouraging dependency, increasing reclamation efforts and providing incentives to develop alternatives (Orlando, 1990:359). Since the excise tax exempted the resale of recycled chemicals, it was felt that more effort would be applied to recycling the controlled substances, and thus shorten the recovery time on capital investments for recycling equipment.

The excise tax applied to 20 ODCs; the eight initial controlled substances and 12 that have since been added by amendment. Tax liability is computed on a semimonthly basis and takes into consideration the weight (in pounds) of ODC, the base tax amount for the calendar year in which the sale or use occurred, and the ozone depletion factor. In 1990, it was estimated that $5 billion would be collected over the next five years from the excise tax (McCarson, 1990:2).

As discussed in the next section, industry in general seems to have responded positively to the intent of the excise tax. The tax in many cases has provided the impetus required to develop alternatives since in effect the tax doubles the cost of ODCs on a per pound basis. Those manufacturers who have not altered their manufacturing process are finding their decisions to be very costly and have been counseled to advise their clients that future costs can be minimized by significantly reducing their dependence on ODCs (Pearson and Schmidt, 1991: 265).

Industry Response

How has industry responded to the concerns over the ozone layer and laws and regulations implemented to protect further depletion? Have their actions or inactions impacted the ability of the DoD to comply with ODC regulations?

In 1991, the EPA estimated that the CFC phase-out would cost the American economy three billion dollars over the next decade (Lyman, 1991:26). A significant portion of this amount would be devoted to research and development for new alternatives, retrofitting existing production equipment and/or buying new capital equipment, changing manufacturing and cleaning processes, and retraining employees. Despite the price tag, though, EPA officials felt that industry had been cutting the use of CFCs in advance of compliance deadline, eliminated easily replaced uses of CFCs, and accelerated research into harder-to-find substitutes. Said Stephen Anderson, an EPA official who co-chaired the Montreal Protocol panel, "Business is moving faster than the law requires" (Elmer-Dewitt, 1992:64).

Some industry analysts felt that the technical challenge of finding replacements for ODCs may be easier than expected. Except for medical aerosols and some others, substitutes exist for most ODCs. Some of the substitutes are very expensive and others pose a different set of environmental problems, but in many cases, the alternatives are better and cheaper (Elmer-Dewitt, 1992:64).

Not all industry analyst share the same optimistic views, though. Some ODC users were struggling to comply with the original phase-out schedules established by the Montreal Protocol. Now that most deadlines have been accelerated, some users are not sure they will be able to comply (Zurer, 1992:7). There are several obstacles standing in the way. Large users and industry have seen the phasing out of ODCs on the horizon for some time and have been working to find alternatives. Businesses who are not members of industry networks and smaller companies lacking in capital, resources, and staff, have had a more difficult time with the changes. Many small companies are hoping the ozone problems will "go away" (Whiting, 1992: 69). The consequences of procrastination though may be disastrous. Without allowing enough time to evaluate alternatives, a less than optimal substitute may be adopted; new manufacturing equipment may not be available on short notice; and in the most extreme case, manufacturing operations may have to cease.

Another issue which causes industry concern is the fact that many of the substitute substances are classified as HCFCs, which originally were not included on the list of controlled substances. These were seen as viable replacements because they contain hydrogen atoms which decompose more rapidly in the lower atmosphere. However they too carry some chlorine into the stratosphere and cause depletion of the ozone layer. Therefore, they are now

being phased-out and are seen as only a temporary substitute to the more toxic ODCs until environmentally desirable alternatives can be found.

In 1990, a DuPont employee testified before a U.S. Congressional subcommittee and had the following to say regarding available substitutes:

> We caution you to be skeptical about claims that technologies other than those using HCFCs are viable in the near term for all current CFC applications. You should question their environmental acceptability, safety, energy efficiency, and ability to be mass produced to meet society's needs. At this time we know of no good lead to the third generation technology and believe that it will take several decades or more to bring such technologies into commercial production, once identified. (Moore, 1990, 321)

Along with DuPont, several other chemical companies calculate that they need up to 60 years of allowable production time for HCFCs and other replacements to justify making multi-billion dollar investments in new factories to meet projected demand; the Montreal Protocol does not allow for 60 years before the time that HCFCs must also be phased-out.

Another problem facing industry is the complexity of chemicals used in the marketplace and the fact that the CAA as amended includes 189 chemicals classified as toxic. Many of the products being used in the marketplace today are blends of chemicals and often it is not obvious to determine the exact content. Sometimes the chemical content is listed in the Material Safety Data Sheet, while other times it is considered to be proprietary data and not available from the supplier. This obviously causes chemical users some problems since they may not be able to absolutely identify those chemicals which are under control.

In many instances industry is forging ahead and discovering alternate processes and materials only to find that the Government is erecting roadblocks. The Government has been hesitant to grant approval to

commercialize many substitutes. Without a prolonged testing period, EPA has been reluctant to grant approval except for a transitional period of time and even then approvals have strict limitations on production and compliance requirements. The reason for the reluctance is that EPA must be assured that any approved substitute has a lower potential for damaging human health and the environment, and without years of strenuous testing, this is often difficult to ascertain.

All is not dismal though from industry's perspective. There are many success stories and many instances where cooperation among companies and agencies have furthered the search for replacements.

In the electronics industry, manufacturers have been eliminating ODCs from their processes and have found improved performance and substantial savings in both time and money. One industry spokesperson felt that by accelerating the phase-out, companies are avoiding potential shortages and higher prices of chemicals. He was quoted as saying, "Total customer satisfaction is the goal and an environmentally sound product, from cradle to grave, has become an integral part of the equation" (Anderson and Zoi, 1993: 61).

Other initiatives that companies are taking to confront the ozone depletion problem are the hiring of more environmental engineers and appointment of top-level environmental policy officers to follow legal issues. Many major manufacturers and users are joining cooperative organizations to pool resources in the development of substitutes. An example of this is the Industry Cooperative for Ozone Layer Protection (ICOLP) which was formed in 1989. The cooperation is a non-profit organization of leading electronic and aerospace companies that were major users of ODCs. Their charter was to

speed-up elimination of ODCs. Aside from multinational corporations as members, the EPA and United Nations Environment Programme, and the World Bank also participate in the organization. ICOLP has successfully organized workshops and demonstration projects in developing countries, developed computerized databases of information, and basically demonstrated that voluntary partnership of Government and industry can be effective while environmental protection and economic development need not be adversarial (Thomas, 1993:59).

Ozone Depletion and the Department of Defense

In the previous sections, the ozone depletion problem was examined, the history of legislation addressing the problem was reviewed, and industry's response and progress to eliminate ODCs and comply with the environmental laws and policies was discussed. This particular section now looks at the effect that ozone depletion has had on operations within the Department of Defense.

Historically the DoD has operated in a reactive mode to environmental considerations. The modus operandi has been criticized by the general public because they perceive the DoD to have an indifferent attitude towards environmental protection. The following statements typify negative sentiments towards the DoD environmental agenda:

> While a generation of new laws and a growing environmental consciousness are bringing private industry to heel, the Department of Defense is America's most pervasive and protected polluter. (McCormick and Turque, 1990:20)

From a House Committee Staffer came the comment, "They (DoD) talk about the environment, Cheney puts out memos, but the reality is are they budgeting the money?" (McCormick and Turque, 1990:22).

In defense of the Department of Defense, Frank Carlucci, former Secretary of Defense was quoted as saying:

> ...there is a natural bond between those who work to protect our environment and those who work to protect our national security. Both believe in the future, both refuse to accept the notion that decay - either in the quality of our environment or in our national defense posture - is inevitable. The same men and women who are committed to protect American freedom are also committed to ensuring that we enjoy that freedom in a clean and healthy world. (Williams, 1989:2)

Why has the Department of Defense been criticized for its environmental attitude? Evidence indicates that the actions DoD takes to meet its mission have resulted in negative consequences to our environment. Consider the following evidence which ties the DoD to the ozone depletion dilemma:

- The military is responsible for over 2/3 of U.S. emissions of CFC-113 (an ODC controlled substance)

- Over 9000 military specifications must be changed immediately to eliminate the requirement for the use of a controlled ODC

- Twenty six DoD contractors and three nuclear weapons plants are blamed for the release of 7.3 million pounds of CFC-113 in 1989

- Military bases used over 5.7 million pounds of CFC-113 in 1989

- Firms that were required to meet military specifications released another 7.24 million pounds of CFC-113 in 1989

- It has been estimated that DoD uses 5 percent of all U.S. CFCs, while 33 percent of Halons, the more difficult of the two categories of ODCs to reduce dependency of, are used in military operations (CFC Phase-out Accelerated..., 1992:13).

These statistics naturally put DoD as one of the major users of ODC and therefore requires that they become heavily involved in the solution.

ODCs have found many uses in the military, some specific to military operations, others similar to commercial applications. Halons have been used for years in fire suppression systems within weapon systems and on military

installations. In fact, Halon-1301 has been dubbed as "the wonder chemical" because of its stable, non-toxic, inexpensive, low-residue, ideal thermodynamic fire extinguishing properties. Halon-1211, although somewhat more toxic, has been proven to be an excellent agent in portable and tank truck fire extinguishing systems. Despite the search, a suitable replacement for the Halons has yet to be found for crew compartments of combat vehicles. No other method, such as carbon dioxide, has proven as effective without being toxic to the crew (Senecal, 1992:182).

Like the Halons, CFCs were considered to be efficient, non-flammable, energy efficient, inexpensive, and non-toxic. Specifically developed in the 1930's as a replacement for ammonia in refrigeration systems, their use has now expanded. Today they are used both in military applications as coolants in command and control centers, on shipboard systems and in other weapon systems; as refrigeration systems for food storage on ships; as foam-blowing agents; and as cleaning solvents for electronic components and other critical weapon parts. Appendix B contains a listing of typical Air Force end uses for ODCs.

However, unlike Halons, replacement for CFCs seem to be more available. Many CFCs are being replaced by HCFCs, which although considered an ozone depleting substance in their own right, contribute 90 percent less on a pound-for-pound basis to global warming and ozone depletion than the CFCs. Other desirable characteristics of the HCFCs are relative low toxicity, low/no flammability, and suitability as a replacement of CFCs (with modification to existing equipment).

However, as discussed earlier, since the original Montreal Protocol was signed, HCFCs have also been added to the list of controlled substances and

by year 2015 must be phased-out. From a replacement standpoint for CFCs, this does not appear to be a problem. It has been projected that by the year 2000, only 40 percent of the projected demand for CFCs will be satisfied by HCFCs; the remaining demand will be satisfied by increases in conservation, recycling, and non-fluorocarbon alternatives (Albert, 1991:188).

How Has DoD Reacted to ODC Legislation?

How has the DoD responded to the ozone depletion problem; what initiatives have they taken; and how will these initiatives impact the development of weapon systems?

As early as 1976, it was concluded that the impact of environmental regulations was a significant factor that should be considered by defense systems Program Managers early in their programs (Graham, 1976: ii). Often environmental considerations are a conflicting objective though, since weapon systems are ultimately supposed to be harmful, not necessarily environmentally sound. Historically the prime objective of any weapon system has been performance, with only second thoughts given to environmental, logistics, supportability, and other ancillary issues.

Because of the emphasis on performance, there are a multitude of systems in the DoD inventory which utilize hazardous materials. Although contributing to performance, the hazardous materials in many cases actually inhibit the overall maintenance and supportability of the systems. An example is an advanced fighter which uses hydrazine as an oxidizer for the gas generator in an emergency power supply. Other materials would have worked almost as well as hydrazine in this function but hydrazine was considered to be the "best". Now the system has become a logistical nightmare to transport,

handle, and store because of the poisonous nature of hydrazine. The maintenance personnel have found that hydrazine emits toxic fumes at room temperature and eats through most containers. The results: deployment of this weapon system is limited to restricted locations because of one small component of the entire system (Williams, 1989:5).

William Parker III, former Deputy Assistant Secretary of the Defense (Environment), had the following to say concerning environmental considerations and impacts on the systems acquisition process:

> In a continuing effort to integrate environmental consideration into day-to-day operations, DoD has instituted processes to evaluate life cycle impacts of weapon systems, products, and procedures. DoD is looking at existing laws to find ways to improve the acquisition process. By integrating environment, safety, and occupational health and planning into DoD's decision making process, we hope to minimize or avoid the environmental impacts of major acquisitions, as well as reduce the life cycle cost of weapon systems; increase worker productivity; provide better and more reliable systems; and increase the environmental accountability of our workers and contractors. (Parker, 1990:26)

With top level policy makers saying environmental concerns will be a factor in the life cycle design of major weapon systems, what has actually been done? DoD Directive 6050.9 was issued in February of 1989 to establish DoD policy and procedures for the elimination of CFCs. The directive is relatively brief (three pages) and very broad in its requirements. The purpose of the directive was to:

- Decrease DoD dependence of CFCs and in the long term eliminate CFCs because of anticipated reductions in availability due to production limits;

- Authorize research and development or evaluation of suitable substitutes; and,

- Initiate a tracking system to document DoD's annual ODC requirements (Department of Defense, 1989).

In addition, DoD Components were directed to review and modify military specifications to permit the use of new processes, techniques, or chemicals for requirements currently being met by ODCs and it assigned responsibility for policy and management, and research and development of alternatives to different offices within the Department of Defense.

The Air Force, recognizing that non-availability of certain chemicals could be disruptive to the Air Force mission, issued Air Force Regulation 19-15 to implement DoDD 6050.9. Some of the requirements contained in the regulation are for the Air Force to demonstrate leadership in protecting the earth's stratospheric ozone layer by eliminating dependence of ODCs; to modify operational, training, and testing practices; to implement conservation measures such as recovery, recycling, and reuse; and to convert existing uses to controlled substances with lower Ozone Depleting Potentials (ODP). The Assistant Secretary for Acquisition (SAF/AQ) was directed to remove all requirements for ODCs from specifications for weapon system development and procurement consistent with established milestones. Each major command was tasked to review specifications, technical orders, and other procedures to prohibit the use of ODCs and then send proposed revisions to the designated preparing party. The DoD's ODC phaseout milestones are contained in Appendix C.

Walter B. Bergmann II, Director of the Manufacturing and Modernization Office of the Assistant Secretary of Defense for Production and Logistics, thought that the DoD had made many strides to eliminate/reduce its

dependence on ODCs. He defended his position in a statement to the House Armed Services Committee in July of 1992:

> - DoD has eliminated/reduced the use of in fire training and operations.
>
> - Refrigeration CFCs and are being reclaimed and recycled through the use of recovery equipment that has been procured.
>
> - CFCs have been eliminated as propellants in aerosols.
>
> - With the exception of mission-critical uses, the use of CFCs and in all new applications has been prohibited.
>
> - Maintenance procedures for servicing of air conditioning and refrigeration systems have been modified to reduce CFC releases.
>
> - A comprehensive R&D program has been established to develop alternative processes, chemicals, and techniques. The strategy is to define requirements for weapon systems, then develop alternative chemicals only if no other technology is currently available. However, it was anticipated that the private sector would be capable of satisfying the majority of DoD requirements.
>
> - The challenge of eliminating requirements for ODCs from specifications and standards is being met by several separate initiatives. First, 600,000 pages of text is being converted to a digitized data base which will allow the DoD to develop a definitive list of documents that require ODCs. 1700 military specifications for passive electronic devices requiring the use of CFCs were changed as of 1 June 92 to eliminate the requirement for CFCs; and 750 military specifications which required solvents testing were revised to offer alternatives to CFC solvents. (Bergmann, 1992: 1-3)

Impact of the ODC Situation on Major Systems

Aside from excluding ODCs in the design of new systems, there are several initiatives underway within the Department of Defense to rid existing systems of dependency on ODCs.

The first, briefly discussed above, was the rewriting of military specifications and other requirements documents to eliminate the direction to use an ODC. Compounding this situation, though, is the fact that due to their high-reliability requirements, military specifications have become world standards in the electronics industry and have driven 50 percent of the world's use of CFC-113 (Sellers, 1991:33).

Case in point, industry claims that one alternate process (the no-clean process) offers a viable long-term solution. The alternate process has the potential to eliminate the costs and environmental impacts associated with the manufacturing, use, maintenance, and disposal of cleaning equipment while also eliminating the problems associated with manufacturing, storing, handling, and disposing of solvents. It has been estimated that this one change to a process will result in energy savings in the year 2010 of more than 4 billion kilowatt hours and a waste savings equivalent to 18,000 tons of CFC-113 (Iman and Lichtenberg, 1993: 63). Yet without extensive testing, which is time consuming and expensive, the DoD has been hesitant to alter the standards without being assured that performance and testing standards will not be degraded.

The second initiative is retrofitting parts on existing systems which require the use of ODCs. This initiative has been influenced by technology restraints, and where technology has been commercialized, supply and demand factors have come into play. Until the EPA and DoD authorize substitutions, manufacturers have been hesitant to invest in new production equipment necessary to manufacture substitute parts. In cases where the EPA has issued preliminary go-aheads for substitutions, the demands for equipment have far exceeded the available supplies.

Redesigning existing DoD systems invokes tremendous complications. Program Directors have to confront issues such as: Is the technology available; does it meet other military standards; has it been approved; is there money in the program budget to cover the expense; will it cause program delays? The Army has reported that redesigning its systems alone will involve the overhaul of 17,000 ground combat vehicles, 8,800 aircraft, 113 watercraft, and over 9,000 structures (Miles, 1992:23). Compound this by the Air Force and Navy requirements and the extent of change becomes apparent.

Given all the complications of integrating environmental considerations into the management of DoD major systems, has the DoD really taken the leadership role in environmental management that its leaders have espoused? Thomas Baca, former Deputy Assistant Secretary of Defense for the Environment, made the recent comment that "Installation activities were kept within the "fence". DoD went about its business with little public scrutiny and sovereign immunity prevailed. We were **The Defense Department**" (Slear, 1993:5). His statement reflects may other's opinions about DoD's historically cavalier attitude towards systems impacts on the environment. Critics are quick to point out that the Department of Defense has made very little head way in the management of its ODC program. Bureaucratic delays and interagency squabbles have been compounded by approaches that emphasize processes rather than final objectives. The complexities of the acquisition system are also said to interfere, as does the fact that Congress, DoD, and the EPA often act as competitors rather than teammates (Slear, 1993: 7). At a lower level, all the Secretaries of each military department have been quoted as taking the position that their respective military department will take the lead and set the example as <u>the</u> DoD environmental leader. With this type of attitude, how much

attention is really focused on restructuring the DoD approach to environmental management in the acquisition process versus trying to out shine other branches of the services?

Unfortunately the answer to this may be less than optimal. In a report conducted by the General Accounting Office in response to a Congressional request, the following was concluded:

> International treaty and U.S. law restrict the production and consumption of ODCs but not their use. Even though the use of ODCs is not restricted, the ultimate intent is to eliminate their use. With this in mind, it is essential that major ODC users take a proactive, rather than reactive, position in working toward an overall phase-out of ODCs. DOD's plan for managing the ODC phase-out will allow the continued use of ODCs for several decades beyond the product phase-out of these chemicals. This practice may be a disincentive for promoting the implementation of safe and acceptable alternatives. (USGAO, 1991:28)

Both the Montreal Protocol and CAA establish limits and controls on the production and consumption of ODCs but does not prohibit the establishment of reserves for use beyond the production phase-out dates. DoD's strategy is to build strategic reserves for "mission-critical" uses to ensure operation of existing equipment until it can 1) implement alternative chemicals, or 2) retire existing equipment (Wyatt, 1993:14). An example of this strategy involves Halon 1211 used by both the Navy and Air Force in fire-fighting systems. Although a potential substitute has been developed (Halotron I) and judged acceptable by the EPA, neither military department intends to switch. The reason for their resistance is the tremendous stockpile of Halon already on hand. The Navy estimates that it may take 20 years to completely phase-out some of its regulated chemicals. The reported reason, however, is that they (the military departments) will not replace Halon 1211 with anything that is not totally free of ODC (Wyatt, 1993:14). For the Air Force, this position contradicts the policy

contained in AFR 19-15 which states that they should be switching to substances with lower ODP in the short term while long term, optimal solutions are in process.

The GAO Report also cited the following five conditions that DoD has not achieved:

1) DoD has not clarified mission critical use. OSD has established broad definitions of mission critical use, mission essential use, and nonessential use but has allowed each military department significant latitude to interpret and apply. "Mission critical" must be determined to have a direct impact on combat mission capabilities, be integral to combat mission assets or affect operability of assets and its uses may be continued beyond when others are phase out. In contrast, "Mission essential" is defined as having an indirect effect on combat missions and to play an auxiliary role in operability of assets. "Nonessential" includes all other uses.

To illustrate the point that the categories are too broadly defined, the Army has designated Halon 1211 in portable fire extinguishers as essential for ground vehicles and aircraft; the Navy considers Halon 1211 as mission critical for aircraft and aircraft carriers. Overall, the Navy has designated 46 percent of CFCs and 91 percent of Halons to be mission critical; the Air Force has defined three mission critical uses (cooling, cleaning and fire protection) and 23 percent of CFCs and 76 percent of Halons are involved in these mission critical applications; the Army, using a more narrow definition, considers just 1 percent of its Halon use to be mission critical. From these statistics, GAO's point is well illustrated. All together, 35 percent of DoD's 1989 ODC purchases were designated for mission critical activities.

2) The DoD has not identified specific chemical uses and quantities. Evidently, a consistent tracking system does not exist across the DoD to pinpoint exactly where ODCs are being used by the military and for what applications. One purpose of DoDD 6050.9 was to develop a tracking system to document DoD's annual requirements of ODC. Without a means to accurately gather this information, individual components will be unable to pass the information to the Defense Logistics Agency (DLA) which has been tasked to identify the needs of the military departments and defense components based on projected replacements of the chemicals, available substitutes, and ongoing R&D. Lack of accurate information means correct amounts will not be procured and stockpiled for mission critical uses. The stockpile will be critical in allowing certain systems to continue in operation in years to come when production by the manufacturing sector has ceased. Without accurate information, DoD is also unable to estimate funding profiles necessary to do R&D testing of alternatives.

3) DoD has not given priority to R&D and testing to implement alternatives. Although it has been estimated that $250 million will be required to test, evaluate, and qualify new materials, the resources have not been adequately provided. Where DoD is a small user of a particular ODC relative to civilian industry, they are relying on industry efforts to develop alternatives. But where applications are DoD unique, funding must be appropriated and initiatives taken. Supposedly, $140 million has been budgeted through FY99 in the service's R&D accounts to develop alternate technology where available substitutes do not exist. In FY91, the Navy planned to conduct 11 CFC and Halon R&D projects. $8.1 million was requested but not included in the approved 1991 President's budget. The Navy was forced to reprogram money

from other areas to fund this research. When the Army discovered its FY92 funds had been reduced, they were unable to conduct evaluation of any alternatives.

Included in the National Defense Authorization Act for FY91 was a requirement for DoD to establish a centralized research program for basic and applied research for the military departments to meet environmental obligations. Congress appropriated $150 million for FY91-92. Military departments submitted at least 12 proposals but none were approved until the proposals included a "five year R&D plan" (an initially unknown and unstated requirement). In this case, the R&D efforts fell victim to red tape and bureaucracy while in the former instances, funding priorities were the culprit for lack of progress.

Sherri Goodman, Deputy Under Secretary of Defense for Environmental Security summarized the shortfalls of the DoD R&D approach:

> Our environmental R&D program is missing two important ingredients: We do not have a fully developed method to match technology developments to real environmental needs, and we have not yet eliminated duplication in our various R&D accounts. (Goodman, 1993:6)

4) The DoD has not justified the need to install equipment that uses regulated chemicals in new and existing systems. DoD Directive 6050.9 required military departments to establish procedures to prevent/minimize CFC and Halon use in existing and future systems. As of the date the GAO report was published, none of the military departments had established such procedures. The Air Force and Navy were installing equipment that used CFCs and Halon without looking at any options or considering alternatives and justifying their decisions by the anticipated improved capabilities and reduced risks of loss of life. As a specific example, the Air Force was planning to install

Halon fire suppression systems in new C-17 aircraft and in engine compartments of B-2 production aircraft. It was questionable whether the decisions to do so were adequately justified.

5) DoD has not revised military specifications/standards to facilitate use of substitutes or alternatives. Although it is estimated that over 9600 military specifications/standards require ODCs to be used, as of 1 September 1991, only one had been revised. The DoD estimated that it takes three months to three years to revise specifications and standards at a total administrative cost of $35 million. Each major command within each military department was charged with the task of reviewing the specifications/standards and submitting proposed changes to the proper responsible party. The Air Force and Navy have said that they generally intend to wait for alternatives to be developed, qualified, and produced before changes are made to military and federal specifications. This position contradicts the Air Force policy which requires each requiring activity to certify with each procurement that they are not requiring the use of or purchase of any ODC. The Army is taking a different approach and intends to adopt non-government standards instead of waiting for alternatives to be identified and approved. Although a more progressive approach, the fact that the three services are not consistently making changes in their acquisition policies will cause manufacturers, producers, and vendors a great deal of trauma as they attempt to fulfill similar requirements under different policies (USGAO, 1991: 1-9).

Summary

Just what is the status of DoD compliance with ODC legislation and regulations? Has industry's actions or inactions affected the ability of DoD to

comply? Are the initiatives set into motion enough to reach total compliance and eliminate all requirements of ODCs from our major systems?

Sherri Goodman, the Deputy Under Secretary of Defense for Environmental Security, has stated that more needs to be done.

> *The DoD must see more real results.* These will only come if among other initiatives, we structure an environmental R&D program to target our most pressing needs and put more senior management attention on contracting techniques, project management approaches, and regulatory impediments to test, measure, refine and apply successes to the clean-up program. The stakeholders must be involved in the decision making process. (Goodman, 1993:1)

The literature review indicates that industry in general has made great strides towards phasing out the production and use of ODCs. Not only has the ODC Excise Tax proved to be economically motivating but the support and flow of information generated by cooperative organizations has provided excellent opportunities for education and allowed for the pooling of resources to develop alternatives and substitutions.

Certain factors have impeded total success, though. These include the bureaucratic roadblocks thrown up by the Government, specifically the EPA and DoD, to approve and accept alternative processes and products.

While the DoD has espoused full support of the ODC legislation, their actions, and in some cases inactions, seem contradictory. It is true that policies and regulations have been written, but how effective are they if not followed? The individual military agencies have been given great latitude to act independently and apparently the empowerment has resulted in varied interpretations and a dichotomy of priorities. Even as early as 1976, John Gratton explored what each of the services was doing to comply with the National Environmental Policy Act (NEPA). The conclusions he came to are

also applicable to the conditions we see today. He found that each service was implementing the public law and DoD directives independently and differently. He concluded that the DoD could benefit from the establishment of a Tri-service organization which would have overall jurisdiction for implementation of the law. They would also be responsible for training. To consolidate all efforts would result in a tremendous savings through economies of scale (Gratton and Kramer, 1976: 82).

The literature review uncovered a mixed reaction to compliance with ODC legislation. The next section discusses the methodology used to collect data from Program Managers of major systems to determine the extent of Air Force compliance.

III. Methodology

Introduction

This chapter discusses the process used to collect primary data to address the investigative and research questions outlined in Chapter I. It provides the rationale for the selection of the research media, a description of the population and method of sample selection, a review of the development of the research instrument, and the basis for data analysis.

Research Design

This research measured the degree of success of Air Force compliance with Ozone Depleting Chemicals (ODC) legislation and regulations, specifically focusing on the acquisition process of major systems. The research examined the impact of the ODC legislation in a program environment, measured the degree of compliance, and identified variables which affected the degree of success.

Because it was important to study selected issues in depth and not be constrained by predetermined categories of analysis or responses, the qualitative method of research was followed. Michael Quinn Patton, author of Qualitative Evaluation and Research Methods, concluded that the qualitative research approach is especially appropriate for changing programs where the focus is on exploring a variety of effects on participants. He said it is an effective evaluation approach to use at major points of transition where change is introduced into a program and the anticipated outcomes, as well as those unanticipated consequences, necessary changes, and program implementation and development need to be monitored (Patton, 1990:12).

The qualitative research method permits in-depth and detailed study of selected issues, captures varying perspectives and experiences of people, and produces a wealth of detailed information about a much smaller number of people and cases. This data can be generalized, within limits, to a population, allowing for the depth of participants' feelings to be revealed (Patton, 1990: 14).

This study reports on actual responses to a real situation; not theoretical responses to a proposed problem. Situational variables were not manipulated, controlled, or eliminated. The study was performed in the natural environment of various program offices.

Based on a technique which Patton called "Summative Evaluation", this research provides an overall assessment of the effectiveness of the program/policy and determined the extent of its effectiveness (Patton, 1990: 24). The Summative Evaluation technique was especially relevant to this research study since the results may be generalized across the Air Force to future situations where environmental legislation is imposed on the acquisition process.

Population

The population applicable to this research project consisted of major systems programs (as defined by DoD Directive 5000.1) assigned to the Air Force Material Command for development and fielding. From this population, the Judgment Sampling technique was used to identify a sample from which data was collected. According to the Air University Sampling and Surveying Handbook, Judgment Sampling is a purposive sampling technique where members from the specific population are selected into a sample to meet a pre-

defined purpose. It excludes outside parties who do not contribute to a stated purpose (Department of the Air Force, 1993:14). The first step of the sample identification process was to identify the target population: all major systems assigned to AFMC with known ODC issues. This was done with the assistance of Headquarters AFMC personnel from the Engineering and Contracting Directorates.

The second step was to identify the actual sample. According to Dillman, the intent of sampling a small portion of a large population is to collect data in a timely manner and then make inferences based on that data about the entire population. A sample cannot be considered representative of a population unless all members of that population have a known chance of being involved in the sample (Dillman, 1978: 18). Therefore, in order to assure validity of the study, once the population was identified using Judgment Sampling, a representative sample was selected using random means. These two steps resulted in a sample of 20 major systems.

Survey Instrument

"Qualitative interviewing begins with the assumption that other's perspectives are meaningful, knowable, and able to be made explicit" (Patton, 1990:7). Patton also wrote that the purpose of open-ended interviewing is not to put things on someone's mind (preconceived notions) but to access the perspective of the interviewee. A researcher interviews because they cannot directly observe or obtain the information we require (feelings, thoughts, intentions, decisions). Patton's perspective was especially relevant to this research because of the need to discover program manager's opinions and

explore the decisions made concerning the implementation of ODC legislation and regulation in the particular program offices.

Based on the information developed in the Literature Review (Chapter II), the small, but geographically dispersed population, and the investigative nature of this qualitative research study, it was determined that the telephone interview was the most appropriate method for data collection. Telephone interviews permitted economical access to the geographically dispersed program managers assigned to the major systems program offices, while retaining many of the strengths of the personal interview.

Don Dillman, author of Mail and Telephone Surveys: The Total Design Method, contends that researchers can now expect to get good results from telephonic interviews that in some cases may be comparable to those which could be obtained through face-to-face interviews and at a much lower cost (Dillman, 1978: 4). Based on an average response from 31 surveys, he calculated a 91% response rate, 17% points higher than the average on mail surveys. This excellent response rate may be partially explained by what he calls the "Social Exchange" theory. The Social Exchange theory asserts that the actions of an individual are motivated by the returns their actions are expected to bring. In the case of a telephonic interview, the ability to establish a credible rapport, explain the study in detail, and motivate the respondents to participate, is far greater than when using an instrument such as the written survey. Dillman agreed and felt that there was a greater likelihood of getting better response to open-ended questions in telephonic interviews (Dillman, 1978: 16).

Other relevant advantages of the telephonic survey included the ability to explore the respondent's answer, probe for additional, relevant information,

determine their degree of knowledge, and determine the intensity of their answers.

The standardized open-ended interview consisted of a set of carefully worded questions presented in the same sequence to each respondent. This technique minimized the potential in variation of questions and thereby reduced the potential to introduce bias. Also minimized was the interviewer effect since questions were standardized; this also served to increase the content validity of the survey instrument. Other advantages of the open-ended interview were a highly focused interview, maximization of interviewing time, and ease in data analysis.

In order to enhance the validity of the survey instrument, it was submitted to members of the ODC Integrated Product Team (IPT) at Headquarters AFMC prior to being distributed to the sample population. Their pretest feedback was incorporated to clarify questions, wording, content, and sequence.

Data Collection

After the pretest phase was complete, written copies of the open-ended survey instrument were mailed to the Program Managers of the sample population with a cover letter. The letter advised them that they had been chosen to participate in this study, detailed the purpose of the study, and indicated what would happen with the results. The Program Managers were advised that they would be contacted to schedule a telephonic interview and were encouraged to read over the survey prior to the time of the actual interview. In this way, they would be familiar with the questions and would have the opportunity to conduct any research that might be necessary to answer the questions. Advance notice was sent to the sample population to eliminate the

element of surprise and to add legitimacy to the surveys. According to Dillman, "A prior letter to the respondents was found to increase the response in surveys. It may be effective because it removes the element of surprise and enhances the importance of exchange considerations in telephone interviews" (Dillman, 1978: 35).

Data analysis is a critical step in any research project, but especially so in a qualitative study. Patton said that the findings, understandings, and insights that emerge from fieldwork and subsequent analysis are the fruit of qualitative inquiry (Patton, 1990: 11). However, unlike a quantitative study, data from a qualitative study does not lend itself to statistical analysis. Instead, qualitative data analysis is a search for general statements about relationships among categories of data and entails three activities: 1) data reduction, 2) data display, and 3) drawing of conclusions/verification. Marshall and Russman described qualitative analysis as an art as much as a study and said

> ...it (content analysis) is a technique for making inferences by objectively and systematically identifying specified characteristics of messages. It is a way of asking a fixed set of questions about data in such a way as to produce countable results. (Marshall and Russman, 1989: 17)

For this particular study a process titled "Phenomenological Analysis" was followed. Patton identified the five steps to this analysis process as follows:

1. The first step was to eliminate all personal involvement and bias from both the data gathering and data analysis phases.

2. Next it was critical to bracket out the world and any presuppositions in order to identify data in its pure form, uncontaminated by all extraneous intrusions. Qualitative research studies the environment in a naturalistic setting, without the manipulation of any variables. The intent is to discover the truth of the situation without any predetermined outcomes to alter findings.

3. The third step entailed "horizontalizing data". This is defined as examining or grouping responses to a common question from different respondents (Patton also refers to this as "cross case analysis"). All elements and perspectives were equally weighed and then organized into meaningful clusters.

4. After data was clustered, irrelevant, repetitive, overlapping data was eliminated. This is known as the "Delimination Process". From the data that remained, patterns, themes, and categories of analysis emerged. Invariant themes within the data were identified rather than being presupposed into the data and natural variation was analyzed.

5. The final step was Structural Synthesis or a description of true experiences encountered and a search for the deeper meaning within the data. The content analysis process entailed identifying, coding and categorizing primary patterns in the data. During this process there was a search for convergence or determining what data fit together, and if there were recurring regularities in the data. Data was sorted into categories differentiated by two criteria; 1) Internal Homogeneity - the extent to which data belongs together, 2) External Homogeneity - the extent to which differences were bold and clear. (Patton, 1990: 36)

Through this process, evolved the interpretations. By Patton's definition, interpreting goes beyond the actual descriptive data, and attaches significance to what was found, offers explanations, draws conclusions, extrapolates lessons, makes inferences, build linkages, and attaches meaning to impose order (Patton, 1990:24).

Because qualitative data and the subsequent analysis process can be very subjective, extreme caution was taken to avoid reading into the findings and over-generalizing. To avoid this problem, Patton advised that three things are expected of the evaluator when interpreting results: 1) confirm what is supported by the data, 2) disabuse any misconceptions, and 3) illuminate important things that weren't known (Patton, 1990: 26).

The ultimate outcome of this analysis process was to identify and extrapolate lessons or factors which may inhibit program effectiveness. Qualitative analysis provided the means of generating powerful insights about

effective program practices or inhibitors to success across multiple experiences and cases.

Summary

This chapter discussed the research design, survey instrument, and data collection and analysis process. Background information was gathered through review of current literature and documented in Chapter II. Using qualitative methods, data was collected. The actual survey instrument was the telephonic interview, chosen because of the defined population and sample, and geographic dispersion of major programs within AFMC. The nature of telephone interviewing allowed for respondents to expand on their answers while allowing the interviewer to probe for more detailed responses. The degree of success with which ODC legislation had been complied with in the program offices was determined from the responses, as well as the identification of variables which have effected full compliance.

In lieu of statistical methods for data analysis, Phenomenological Analysis was chosen as a means to interpret the qualitative data. Following set procedures, the data was analyzed and interpreted to address the investigative questions posed in Chapter I.

The next chapter, Chapter IV, presents analysis of the research instrument.

IV. Results and Analysis

Chapter Overview

The purpose of this research was to determine if the Air Force was prepared to support the reduction and elimination of Ozone Depleting Chemicals (ODCs) from its major acquisition systems and if the proper mechanisms had been put into place to facilitate the necessary changes. If variables were present that affected successful implementation of this environmental initiative, then it was also the intent of this research project to identify such variables. The research was accomplished by interviewing Air Force Program Directors assigned to major defense acquisition programs from multiple Air Force Material Command (AFMC) acquisition centers. This chapter describes the sample of programs that was selected and analysis of data that was collected in response to the research questions. The data is presented in correlation with the investigative questions presented in Chapter One.

Overview of Data Collection Process

As previously detailed in Chapter Three, a telephonic survey was the basis for data collection on this research project. The survey consisted of six sections which contained questions designed to obtain information to answer the investigative questions set forth in Chapter One. Copies of the survey questions were mailed directly to the selected Program Directors on 2 May 1994; approximately two weeks were allowed for distribution, review, and preparation of responses. Telephonic surveys began on 15 May 1994 and

were concluded on 12 June 1994. A copy of the survey instrument appears in Appendix D of this thesis.

Sample Population

The sample population involved with this research project included 20 major Air Force programs assigned to Program Executive Officers (PEOs). This sample represented 61 percent of the total number of major Air Force programs. The 20 programs included ten Aircraft programs (representing 100 percent of that total sub-population) and 10 Non-Aircraft programs (representing 43 percent of that total sub-population). The Non-Aircraft programs included satellite, missile, ammunition, information management, and Foreign Military Sales (FMS) programs.

Sample programs represented all phases of the acquisition cycle; however, a greater proportion were in the latter stages of Engineering Manufacturing Development, Production, and Operations and Support.

Locations of the sample programs included five different AFMC acquisition centers and three logistics centers.

Appendix E contains a copy of data which was collected from the survey and horizontalized, or clustered, into meaningful categories. The information that follows represents further analysis of that collected data.

Investigative Question One: To What Extent Were Air Force Acquisition Systems Dependent Upon ODCs?

Was the Air Force relying on the use of ODCs in the development and operations of its major systems, or were a tremendous amount of resources and attention applied to a topic that concerned relatively few programs? This issue

was answered by the responses to the question which asked the Program Directors if prior to the passing of the National Defense Authorization Act (NDAA), were ODCs or the use of ODCs important to the successful completion of their programs. The responses are presented in the following table.

TABLE 1

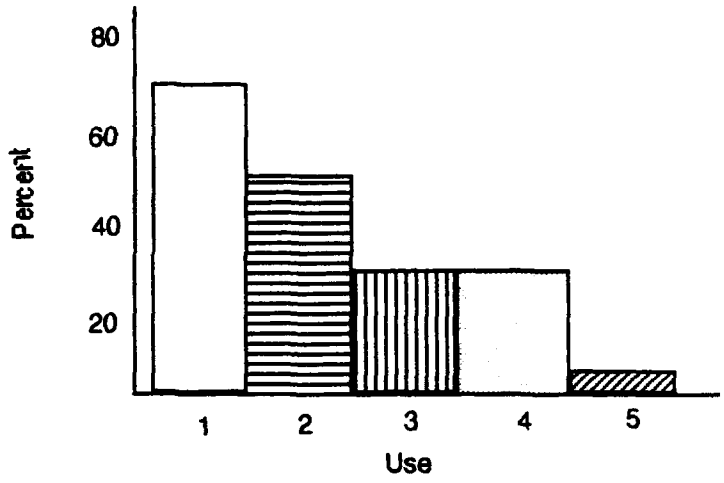
RELIANCE OF PROGRAMS ON ODCs

Response	No. of Responses	Percent of Total	Aircraft Program Responses	Non-Aircraft Program Responses
No	6	30	1	5
Yes	14	70	9	5

Thirty percent of the Program Directors indicated that they were unaffected by ODCs. Reasons cited included the fact that several programs were in the conceptual or early design phase where designs were still fluid. In these cases, the Program Directors had built in the requirement to avoid the use of all ODCs as either an end product or incorporated into any processes. Thirty percent of the sample population consisted of information systems which did not require the development of any hardware and therefore, had no opportunity to introduce ODCs. Another program was primarily acquiring Non-Developmental Items (NDI) and had cited commercial specifications only.

Of the 70 percent of remaining programs that did rely on ODCs prior to the issuance of the NDAA, how were the uses categorized on the programs? Figure 1 depicts the uses of ODCs on the majority of the programs.

Analysis of the use of ODCs in major systems programs showed that 90 percent of the aircraft programs and 50 percent of the non-aircraft programs



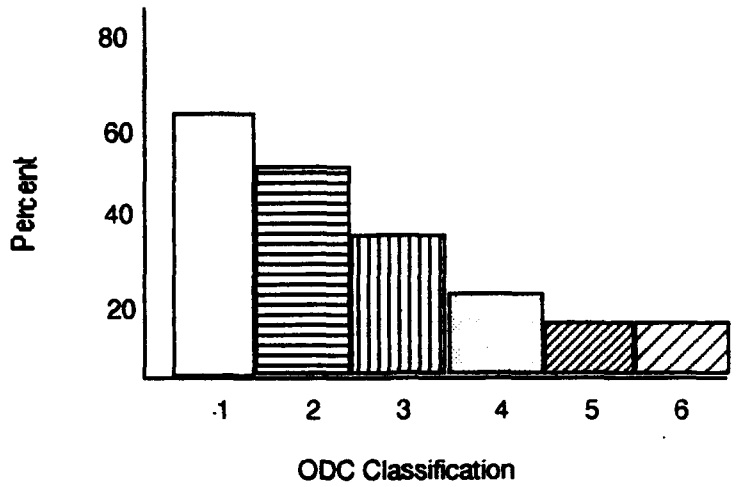
Use: 1 - Cleaning Solvents
2 - Fire Protection
3 - Cooling
4 - Painting/Depainting
5 - Other

Figure 1. Categorization of ODCs

were using ODCs as cleaning solvents. Ninety percent of aircraft programs reported that they were relying on ODCs for fire protection, while only 20 percent of the non-aircraft programs indicated they used ODCs for fire protection. ODCs for cooling purposes were more evenly distributed among all programs with 40 percent of the aircraft programs and 30 percent of non-aircraft programs reporting reliance for this purpose. Painting/Depainting processes incorporated ODCs in 35% of the total programs; 30 percent of aircraft programs and 40 percent of the non-aircraft programs. One non-aircraft program indicated that they relied on ODCs for thrust control (Other).

Further investigation into the reliance of ODCs revealed the classification of ODCs used on the major acquisition programs. Chloroflurocarbons (CFCs)

and Halons were the two predominant classifications of ODCs which the programs were dependent upon as evidenced by Figure 2.



ODC Classification:

1 - Chloroflurocarbons
2 - Halons
3 - Methyl Chloroform
4 - Carbon Tetrachloride
5 - Methyl Bromide
6 - Hydrochloroflurocarbons

Figure 2. Classification of ODCs

Of particular significance was the distribution of reliance on CFCs and Halon among the various programs; 80 percent of the aircraft programs reported using CFCs, while only 50 percent of the non-aircraft programs indicated reliance on CFCs. For Halon use, the gap widened; 90 percent of aircraft programs relied on Halon, while only 20 percent of the non-aircraft programs reported that they used Halon.

How critical was the use of the ozone depleting chemicals to the mission of the various systems? Both the Clean Air Act and Air Force Regulation 19-15 contain definitions which allow the use of an ODC to be classified. Although the Air Force definitions were based on those contained in the Clean Air Act, they had been modified slightly. For purposes of this research, the Program

Directors were asked to classify the ODC dependence based upon the definitions from the Clean Air Act as follows:

Mission Critical: Has a direct impact on the combat mission capability. Use is integral to combined mission assets or affects the operability of assets.

Mission Essential: Has an indirect effect on the mission and plays an auxiliary role in the operability of assets.

Nonessential: All other uses (US GAO, 1991:12).

Of the 70 percent of Air Force programs which relied on ODCs, how had the reliance been classified according to the definitions set forth above? The following table sets forth the highest classification on the program; in several instances, Program Directors reported that multiple classifications applied depending upon the use of the ODC.

TABLE 2

CLASSIFICATION OF ODCs

Definition	No. of Responses	Percent of Total	Aircraft Program Responses	Non-Aircraft Program Responses
Mission Critical	11	79	7	4
Mission Essential	1	7	1	0
Nonessential	2	14	1	1

Analysis of the data presented above revealed the primary reason that 79% of the programs depended upon ODCs to support mission capability was due to a reliance on Halon for fire suppression. Greater than 75% of the programs classifying ODC use as "Mission Critical" did so because of the dependence on Halon; one program reported that a combination of three primary ODCs had a direct impact on mission capability; another indicated that

ODC use for an air conditioning requirement caused a "Mission Critical" rating; and the last program reported that an ODC dispersant in the propellant critically impacted their mission.

The "Mission Essential" rating was based on incorporation of ODCs in the manufacturing and support phases for use as a solvent. "Nonessential" ratings were given because the ODCs were used in manufacturing or repair processes which could be easily altered.

The Fiscal Year 1993 (FY93) National Defense Authorization Act (NDAA) established the first real, tangible requirement to eliminate ODCs from acquisition programs. The law was applicable to all programs, not just those in the conceptual or design phases. What impact did the requirement to reduce/eliminate ODCs have on Air Force major systems programs?

Of the 70 percent of Program Directors reporting an impact by the NDAA requirements, four aspects of program management were repeatedly chosen as having been substantially impacted. Those four aspects, in order of importance, were:

1. Financial
2. Contractual
3. Operations and Support
4. Manufacturing Processes

Seventy-nine percent of the programs reporting an impact by ODCs ranked the financial aspect of program management as one of the top three of the aspects most impacted. The primary reasons for financial impact included the fact that money to fund the effort to reduce/eliminate ODCs had to come from existing program funds, often at the expense of improvements to vehicle performance or reliability. In several instances, in-house expertise did not exist or workload did not permit the preliminary analysis work to be done within the

program offices. Several program offices paid contractors to analyze the ODC situation and make recommendations for compliance with the NDAA and DoD requirements.

The second aspect most often cited was "Contractual" primarily due to the extensive reviews of contractual documents that was required in order to identify where ODCs had been specified. In addition, after 1 June 1993, contracting actions which met certain thresholds could not be awarded until a complete analysis of ODCs was completed and certifications were made. Due to the late issuance of guidance and waiver procedures, several program offices experienced a delay in the award of contractual actions.

Operations and Support was ranked as the third most impacted area of program management. According to data collected for this study, at least 50% of the sample programs reported that their programs were in the Operations and Support phase of the acquisition cycle. This was significant because any redesign or substitution at this later stage in the program's acquisition life cycle had significant ramifications; designs had to reaccomplished thereby causing changes to configurations. In addition, Technical Orders to support operational use typically had been developed for the Operations and Support phase and a great deal of resources were required to modify the documents.

Also causing an impact to operations and support was the difficulty in procuring certain ODCs through commercial channels. This difficulty resulted in one program being force to modify certain operational procedures.

The last major aspect to be cited, Manufacturing Processes, was mentioned because of the processes that had to be changed and new equipment that was purchased as a result of the requirement to reduce/eliminate ODCs.

Investigative Question Two: To What Extent Had Program Directors Been Provided With the Information On the ODC Situation, and Tools and Knowledge Required To Reduce/Eliminate ODCs From Their Programs?

The FY93 NDAA was the trigger within the Department of Defense to reduce/eliminate reliance on ODCs. However, prior to the passing of this legislation, much activity and discussion had occurred on a national level with regard to ODCs, the extent of ODC-related problems, and measures which had to be taken to comply with phaseout schedules established by the Montreal Protocol. By the time the DoD and Air Force issued policy and directives on the elimination of ODCs, production deadlines for certain ODCs and deadlines to eliminate the requirement of Government specified use of ODCs in Federal procurements were rapidly approaching. Were Air Force Program Directors concerned with the elimination of ODCs from their acquisition programs prior to the issuance of the National Defense Authorization Act, and had they taken any early measures? The response to this question is captured in Table 3.

TABLE 3

EARLY CONCERN WITH ELIMINATION OF ODCs

Response	No. of Responses	Percentage of Total	Aircraft Program Responses	Non-Aircraft Program Responses
No	10	50	5	5
Yes	10	50	5	5

The response to this question was divided equally among those that were aware of and concerned with the elimination of ODCs prior to the passing of the legislation and those that were not. Although half of the Program Directors responded that they were not concerned with early elimination of

ODCs from their program, this cannot be interpreted as a total disregard for the ODC issue. They knew that the elimination of ODCs would be a problem that must be faced in the near future, but until the DoD and Air Force had issued policy and directives, they were hesitant to apply their limited resources to an issue that had not been fully defined.

In particular, the issue of the applicability of ODCs to Foreign Military Sales (FMS) programs was raised; was the sponsoring country a party to the Montreal Protocol; would Air Force policy apply or would the sponsoring country's policies dictate the actions which would be necessary?

Other programs were not concerned with the early elimination of ODCs because they knew that, although ODCs were used on their program in various processes, the use was not dictated by the Government but rather selected at the contractor's discretion. Still yet other programs were in the early design phase and could bypass ODCs altogether, thereby eliminating the need later to find replacements.

The other half of the Program Directors indicated that they were concerned with ODCs prior to the passing of the NDAA. What was driving their concern and what actions did they take prior to FY93?

Several Program Directors reported that their actions were actually triggered by the passing of the Clean Air Act Amendments of 1990. As early as 1988, they understood that ODCs would eventually have to be eliminated, and rather than wait several more years, they chose to apply resources early. In some cases, the program contractors took the initiative to eliminate ODCs from all of their processes, either due to the eventual end of production of ODCs or because of stricter state environmental laws. In particular, the states of California, Texas, New Jersey, and Massachusetts required the earlier

elimination of ODCs. In either event, the Air Force Programs were a direct benefactor of the contractor initiatives. By FY93 when the NDAA was passed, those programs which had been concerned early with the elimination of ODCs reported that the majority, if not all, of ODCs had been eliminated.

Other Program Directors chose to include the requirement to eliminate ODCs in their pollution prevention programs, and incorporated the requirement to eliminate or identify ODCs into contractual documents. One other aircraft program had kept informed of attempts to identify a suitable replacement for Halon 1301 as a fire suppressant and realized that this task was not going to be easily solved. Their upfront actions included establishing a venture with Wright Laboratory to search for suitable replacements for their program.

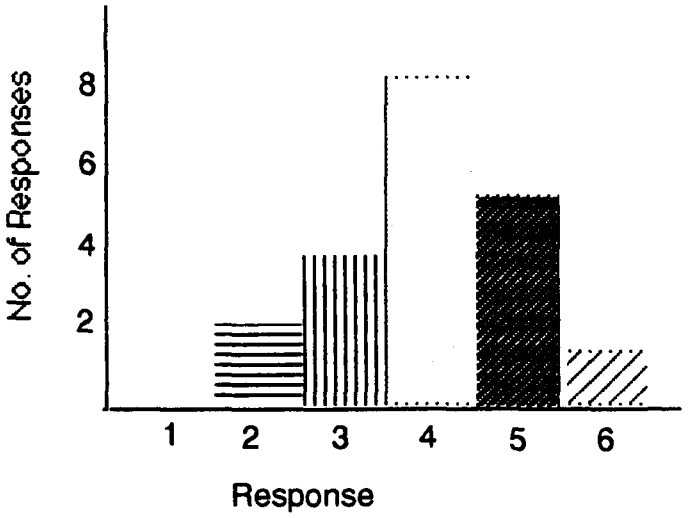
After the NDAA was passed, a flurry of activity began that resulted in the issuance of policies, directives and general information to the acquisition Program Directors. What sources did the Program Directors receive their information from and how useful did they find the information that was received? Table 4 captures the responses from the Program Directors.

The data revealed that all Program Directors received information in the form of official correspondence and 80 percent attended official briefings in addition to the correspondence. In general, the Program Directors acknowledged that they had received a great deal of information on ODCs from a variety of sources. But, how did they rate the information that was received? Figure 3 reveals that 70 percent considered their information to be less than adequate to perform the task that was expected of them.

TABLE 4

SOURCES OF INFORMATION

Information Source	No. of Responses	Percentage of Total	Aircraft Program Responses	Non-Aircraft Program Responses
Official Correspondence	20	100	10	10
Official Briefings	16	80	9	7
Personal Reading	14	70	8	6
AFMC Video	8	40	6	2
Formal Courses	5	25	3	2
Other	4	20	3	1



Response: 1: Very Inadequate
2: Inadequate
3: Somewhat Inadequate
4: Somewhat Adequate
5: Adequate
6: Very Adequate

Figure 3. Adequacy of Distributed Information

The reasons cited that caused the Program Directors to rate distributed information as less than adequate were multiple. Those consistently cited were as follows:

- Apparent lack of real understanding of the ODC issue was reflected by the large amount of initial confusion, the excessive amount of time between

passing of the legislation and issuance of policy and guidance, and the vacillation in policy dependent upon issuer.

- Distributed information reflected changing priorities, the lack of long term plan, the absence of a unified approach among DoD components, and unclear expectations of Program Directors.

- Due to the delay in issuance of policy, Program Directors were then confronted with unrealistic suspenses and expectations, and compressed schedules.

- Although expectations were eventually set forth, no additional funding to implement the changes was provided. Program Directors were expected to make the Herculean changes using already scarce program funds. In addition, funds could not be budgeted in the POM cycle if quickly approaching deadlines were to be met.

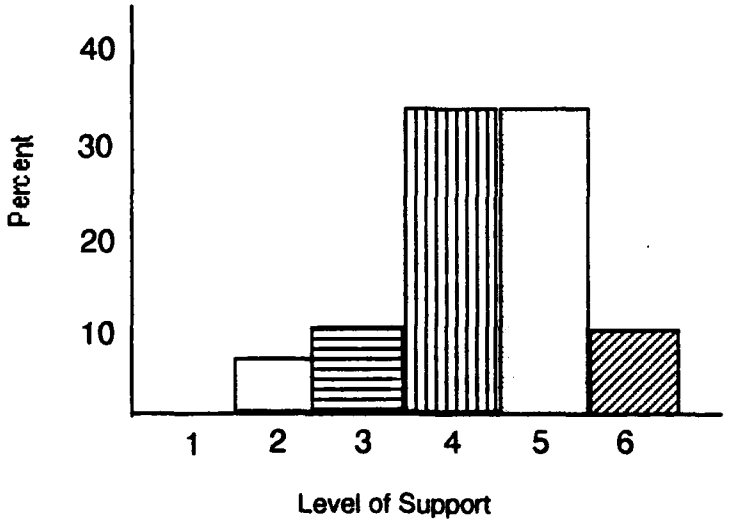
- Adequate information was received to describe the ODC issue and associated problems. However, the information did not provide actual procedures which could be followed to implement the changes. To meet the short suspense, actual step-by-step directions on how to reduce/eliminate ODCs should have been issued.

- Too many sources were involved in issuing guidance. Often duplicative information was received from multiple sources, sometimes each establishing a slightly different requirement.

- Twenty percent of the programs were "Information Systems" and were not concerned at all with ODCs, yet they too continued to receive all distributed information. There was a consensus that the distribution lists should be tailored and information directed to only applicable addressees.

In contrast to those who rated the information as less than adequate, 30 percent of the Program Directors rated information as adequate or very adequate. They considered the ODC information to have been concise and direct which, they noted, was in marked contrast to the confusing and, at times, conflicting guidance which had been provided on other pollution prevention related topics. Expectations were clearly established and Program Directors were able to effectively react.

Despite the reported impacts to program management cited above, Program Directors had been able to make progress to reduce their program's reliance on ODCs. Program Directors were asked to rank the level of support that they had received to reduce/eliminate ODCs from their programs and were also asked what priority, relative to other programmatic issues, the reduction/elimination of ODCs had received. The results are presented below in Figure 4.



Level of Support:
1 - very unsupportive
2 - unsupportive
3 - somewhat unsupportive
4 - somewhat supportive
5 - supportive
6 - very supportive

Figure 4. Level of Support Received by Program Directors

Reasons cited for less than a supportive rating echo data that was earlier reported. Program Directors conveyed that the primary reason they were not adequately supported to tackle this initiative was the fact that money to implement changes did not accompany directives to make changes. In one instance, a Program Director converted the funding issue to operational terms and briefed the Center Commander with statistics on the number of planes that would be grounded because of the diversion of funds to tackle ODCs.

In addition to lack of funds, several Program Directors stated limited guidance and an uncoordinated effort at levels above the program offices contributed to a chaotic, unsupported attempt to reduce/eliminate ODCs. They thought that unrealistic deadlines were instituted because those establishing the deadlines were served by staffs that did not understand the range and scope of the ODC effort, the impact on acquisition programs, and the time required to solve the associated issues. Another Program Director thought the lack of support was attributed to the lack of an organized Air Force or DoD infrastructure to counter ODCs, as well as other environmental problems confronting the acquisition community.

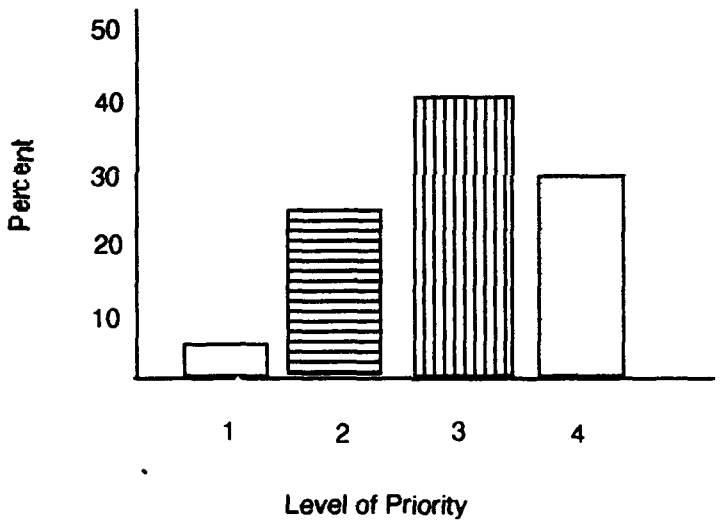
Almost half of the Program Directors did report that they were well supported in their attempts to reduce/eliminate ODCs. This support was attributed to materials developed and distributed by Human Systems Center, and manpower and information provided by center Environmental Management Directorates, particularly the office at Aeronautical Systems Center (ASC).

All Program Directors agreed that the Program Executive Officer (PEO) had remained a neutral party throughout this time period and had not tasked the program offices to gather data or complete tasks above that which had already been requested. On the other hand, the PEO staffs were not cited as having

had the expertise to assist the program offices in their environmental endeavors.

With over half of the Program Directors reporting less than supportive assistance from higher levels of management and 75 percent indicating that distributed information was below adequate, was little management attention paid to the requirements to reduce/eliminate ODCs from acquisition programs?

The data indicates that this was not the case; 70 percent of the Program Directors reported that they had given this environmental issue a moderate to highest priority relative to other programmatic concerns. See Figure 5 that follows.



Level of Priority: 1 - None 2 - Low 3 - Moderate 4 - Highest

Figure 5. Level of Priority Assigned by Program Directors

What were the factors which drove Program Directors to assign the higher priorities? Repeatedly it was reported that the motivator was the realization that the requirement to reduce/eliminate ODCs stemmed from a

Public Law which if not complied with, would carry serious ramifications. Others cited a quality philosophy of "either do it right or don't do it" which drove them to put forth their best effort. Two different Program Directors attributed their ability to assign the elimination of ODCs a moderate to highest priority to contractors. In one case, the contractor had been independently proactive and had put the program into a better position to complete the elimination of ODCs within established deadlines; in the other case, yearly competition between two contractors had forced them to be proactive and supportive of the program office's initiatives to eliminate ODCs.

Funding constraints were cited as the primary reason that ODC elimination was given a less than moderate priority. Twenty five percent of the programs were doing what they could do to eliminate ODCs but were severely constrained by lack of funds. Finding alternatives to a system which had previously been designed and was in production represented a costly endeavor, and one that was not likely to result in an equitable benefit to the program.

Investigative Question Three: To What Extent Had Alternate Technologies or Products Been Identified as Economical Replacements for ODCs and to What Extent Had Substitutions Been Made?

Since the time that the NDAA was passed, and in some cases prior to that date, a portion of the Program Directors had been concerned with identifying alternatives to ODCs used in the production and operations of their acquisition programs. As discussed in Chapter Two, industry had for some time also been involved with a search for alternatives to ODCs. Did the findings from industry's initiatives and the Program Directors' searches result in the

identification of less harmful substitutions to the Ozone layer, and were the substitutes economically feasible? These issues will be explored in the following section.

From the 80 percent of Program Directors faced with identifying alternatives to ODCs, 94 percent responded that they were aware that alternative materials or processes had been identified that would allow for the eventual elimination of ODCs from their program. However, 31 percent also said that for specific ODCs, appropriate alternatives had not yet been identified.

Overwhelmingly, the responses indicated that alternatives had been identified for the CFCs primarily used in the cleaning of electronic and metal parts, and degreasing processes. This conclusion was not surprising considering the fact that CFCs were vital to industrial processes and it was estimated the 20-24 percent of the world-wide consumption of CFCs was used by the electronics industry to clean flux residues from electronic equipment (Iman and Litchenbery, 1993: 62). Naturally, this was the area where industry and cooperative organizations had focused their attention to develop or identify suitable alternatives to ODCs. Acquisition programs directly benefited from their previous efforts.

The 31 percent who reported that substitutes had not been identified were specifically referring to ODCs used in fire protection systems (namely Halon), and for refrigeration and cooling purposes. In all cases, the Program Directors were aware of on-going research and development efforts and were awaiting the results before making any substitutions on their programs.

Although the data overwhelmingly indicated that alternatives to certain ODCs had been identified, this did not directly translate into substitutions being made on the major acquisition programs. Other factors affected the decision to

actually make the substitutions: were the alternatives economically feasible; had extensive testing been done and were results available to the Program Directors; was the Ozone Depleting Potential (ODP) factor less than that of the ODC currently being relied on; and to what extent were the alternatives classified as Hydrochloroflurocarbons (HCFCs), a Class II ODC also targeted to be phased out of production and use?

The following concerns were specifically voiced by Program Directors as the basis for not having made substitutions on their programs:

- Extensive testing must be done to ensure that any alternatives will meet the program's performance requirements;

- The contractor had not accepted any changes yet because they were fearful of potential associated liability and warranty problems;

- Identified alternatives may contain elements from the EPA list of 17 hazardous materials, which also eventually will have to be eliminated from use.

When asked if the identified alternatives were commercially available, 81 percent of the Program Directors responded that they were and 85 percent of this majority group also considered the alternatives to be economically feasible. Responses indicated that commercial alternatives for CFCs were widely available, and since many were water-based solvents, they were economically feasible. The 19 percent who were not included in the group who thought alternatives were commercially available responded so because they were unsure of the commercial availability until further exploration was done.

The remaining 15 percent stated that although alternatives may have been commercially available, they were not economically feasible. These program directors based their responses on the premise that extensive redesign would be required to retrofit their systems to accommodate the

alternatives. All their programs were either in the production or deployment phase of the acquisition cycle.

Of the Program Directors concerned with finding alternatives for ODCs, 71 percent responded that they knew the ODP factors for alternatives were lower than the ODCs currently being relied on. The remaining 29 percent had not had access to this data and were unsure of the ODP factor for potential alternatives. Fifty-four percent said that they knew identified alternatives were not classified as Class II HCFCs; 33 percent said potential alternatives were HCFCs; 13 percent were unsure if the alternatives were Class II ODCs.

Although the HCFCs will also be eventually phased out of production and use, several Program Directors had decided to substitute them into their systems as a temporary fix until a more suitable, permanent solution could be identified and tested. Two of the HCFCs being incorporated were substitutes for freon. One Program Director was trying to balance reality with long-term solutions and had incorporated an HCFC as a substitute but projected that his system would be phased out of the DoD inventory prior to the time the production ban on HCFCs went into effect.

Investigative Question Four: To What Extent Had ODCs Been Eliminated From Air Force Acquisition Programs, Including Technical Documents?

Sixty percent of the Program Directors report that the requirement for an ODC as an end product still existed on their program as of the time the data was collected. This statistic consisted of 80 percent of the aircraft programs and 40 percent of the non-aircraft programs. The primary class of ODCs cited as still existing on the programs were the Halons. A smaller percentage, 30 percent, stated that their program still relied on the incorporation of ODCs through a

process. In these cases, ODCs were still being primarily used as solvents in cleaning processes.

Seventy-five percent of the Program Directors responded that they had made substitutions to ODCs on their programs. From this group, 54 percent reported that some aspect of their program had been impacted; the remaining 46 percent reported no impact. From the data that was collected, the most significant areas of impact included financial, contractual, performance requirements, operations and support, and manufacturing processes.

This data must be interpreted carefully keeping in mind information that was presented earlier. Although alternatives had been identified for many ODCs, other factors may have kept Program Directors from introducing substitutes into their program. Substitutions that were made were primarily in the area where industry had conducted extensive research and testing. That was on substitutes for solvents, primarily CFCs, used in electronic processes. The Program Directors reported that substitutes for these purposes were either "drop-ins" or required very little changeover costs. In some cases, they did say that it was too early to judge if the substitution would cause an impact.

The ODCs that remained on the acquisition programs represented those for which alternatives had not yet be identified, testing was inconclusive, or commercial availability or economic feasibility was prohibiting the change from taking place.

The Secretary of Air Force and Chief of Staffs' Action Memorandum on the Air Force Ban on ODCs, dated 7 January 1993, established specific requirements to eliminate ODCs from specifications, standards, and technical orders. Specifically, it assigned the tailoring responsibilities for specifications and standards to SAF/AQ, AF/LG, and AFMC and required that responsible

activities forward a copy of tailored specification pages to the preparing activities. Further, it tasked AFMC to review all Air Force technical orders to identify ODC usage and provide a master list to Program Managers and Directors. By 1 April 1994, Program Managers and Directors were to have revised applicable programmatic technical orders to allow for the use of non-ODC alternatives (Secretary of the Air Force, 1993: 4).

How far had this task progressed as reported by the selected Program Directors and was the goal of 1 April 1994 met?

Program Directors were asked if they were aware of any Air Force or DoD-wide cooperative efforts to screen technical documents to include specifications, standards, and Air Force Technical Orders. Ninety percent reported that they were aware of such efforts, and from this group, 83 percent reported that they had directly benefited from the cooperative efforts. Examples of the cooperative efforts cited included the AFMC specification database (cited by 30 percent of the Program Directors), and cooperative Center activities, usually headed up by the Environmental Management Directorate (cited by 40 percent of the sample population). The Program office for a joint Air Force/Navy program indicated that they had benefited from a joint Air Force and Navy database. Problems voiced with the cooperative efforts included the concern that although results and benefits were forthcoming, the rate had been extremely slow. One Program Director was aware of numerous approaches to screen documents, but felt that the overall approach was fragmented to the point that there was uncertainty about which were the strongest and most reliable screening efforts.

The Secretary of the Air Force established 1 April 1994 as the goal for revision of programmatic technical documents to allow for alternatives to ODCs.

As of May/June 1994 (period during which data was collected), what was the status of this process among the sample population?

Fifteen percent of the Program Directors reported that this activity was a non-issue on their program (their documents did not include any references to ODCs); 30 percent reported that their efforts were complete; while 55% percent reported that efforts were on-going. Of the 11 programs that had not completed the programmatic technical documents review, eight reported that they had involved their contractors in this effort and it had taken time to compile a work task, issue a Request for Proposal (RFP), evaluate offers, and process the contractual paperwork. Of those eight programs, five were still in the pre-award phase, while three had awarded contractual documents and were awaiting the results.

The methods used by various program offices to screen technical documents differed but basically fell into two categories: 56 percent reported that the searches were being done by manual review; 44 percent indicated that databases had made it possible to use word searches to identify ODC requirements.

Who was actually conducting the search of technical documents? The majority reported that contractors were involved in the process. Sixty percent of the Program Directors indicated that they were forced to rely on contractors due to lack of resources or knowledgeable personnel within their program office; 40 percent reported that contractors were not involved. From the portion of programs that involved contractors, 64 percent responded that contractor involvement was required by the Government, 36 percent said that contractor involvement was voluntary. One Program Director indicated that their using

command was completing the screening process and only minimal participation on their part was required.

In the cases where contractors had been involved, what had the contractors been tasked to do? From the data results, contractors had primarily been instrumental in developing digitized databases to allow for automated word searches; in some cases the databases were required deliverables. In several instances, contractors had been the primary focal points for conducting screening efforts; in other instances, the contractors had served as reviewers of the initial screening efforts done by Government personnel. Still, in another program office, the contractor had been tasked to not only identify the occurrences of ODCs, but to actually make required changes to the programmatic documents.

The effort to identify and revise programmatic technical documents to allow for alternatives to ODCs was time-consuming and expensive. The data captured in Table 5 reports the estimated costs paid to date to contractors and expected future costs to eliminate ODCs from the major programs, as reported by twelve Program Directors.

As previously reported, 40 percent of the program offices were solely responsible for searching the programmatic technical documents; of the remaining 60 percent that involved contractors in the search activity, a portion also utilized program office personnel. Table 6 presents the data from fourteen programs on time invested by program office personnel, either solely or in addition to the efforts of a contractors, to search programmatic technical documents.

TABLE 5

DOLLARS PAID TO CONTRACTORS
TO ELIMINATE ODCs FROM MAJOR PROGRAMS
(DATA REPORTED IN MILLIONS OF DOLLARS)

PROGRAM	COSTS PAID TO DATE	EXPECTED FUTURE COSTS	TOTAL COSTS
1	10.0	140.0	150.0
2	0.0	25.0	25.0
3	1.5	17.5	19.0
4	0.5	9.0	9.5
5	4.9	2.0	6.9
6	1.9	2.4	4.3
7	0.6	2.0- 5.0	2.6 - 5.6
8	1.2	1.0	2.2
9	0.0	1.5	1.5
10	0.187	0.125	0.312
11	0.123	0.005	0.128
12	0.8	0.0	0.8

TABLE 6

TIME INVESTED BY PROGRAM OFFICE PERSONNEL
TO SEARCH PROGRAMMATIC TECHNICAL DOCUMENTS
(DATA REPORTED IN MAN YEARS)

PROGRAM	TIME INVESTED TO DATE	TIME REQUIRED TO COMPLETE	TOTAL TIME
1	4.6	0.0	4.6
2	2.0 - 3.0	1.0	3.0 - 4.0
3	1.0	1.0	2.0
4	0.83	0.83	1.66
5	0.16	1.0	1.16
6	1.0	0.0	1.0
7	1.0	0.0	1.0
8	0.5	0.5	1.0
9	0.83	0.0	0.83
10	0.33	0.25	0.58
11	0.25	0.0	0.25
12	0.08	0.0	0.08
13	0.08	0.0	0.08
14	0.04	0.0	0.04

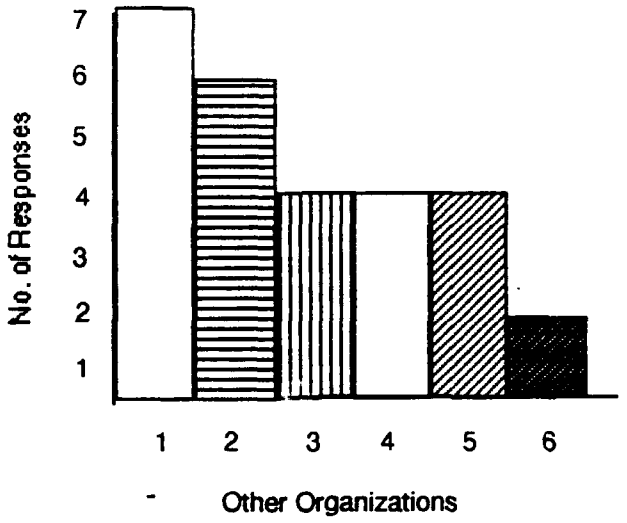
From the data reported in the preceding tables, it was concluded that a significant amount of time and money had been spent by both program office

personnel and program contractors to identify and eliminate the occurrences where ODCs were specified in programmatic technical documents. The methods employed, as well the resources applied to conduct the searches, varied from program to program. Since exact procedures to meet this requirement were not established by the Air Force, each Program Director had selected the procedures that they independently determined to be the most effective. Considerable variance existed between adopted processes which also contributed to variance among task completion dates.

Investigative Question Five: Had Program Directors Benefited From Cooperative Efforts Taking Place Within The DoD, Federal Government, and Private Sector?

Elimination of ODCs was a task confronting not only the DoD but all of the Federal Government and private sector, as well. In addition, numerous countries were party to the Montreal Protocol and had stepped up to the commitment of the phaseout of ODCs by specific dates. A task of this magnitude required the cooperation of many organizations. Did this atmosphere of cooperation prevail throughout the acquisition community during efforts to identify alternative materials or processes? Were Program Directors operating in a vacuum to find suitable substitutes or had resources been pooled and information shared where results could benefit other programs?

From the data collected, it appeared that Program Directors were turning their attention outward to search for solutions to similar situations that involved ODCs but perhaps not to the fullest extent possible. Figure 6 below depicts outside sources that Program Directors turned to for support and information.



Other Organizations: 1 - Other Organizations within the DoD
2 - EPA
3 - Other Air Force Program Offices
4 - DoD Labs
5 - None
6 - Other

Figure 6. Other Organizations Relied Upon for Information on ODC Alternatives

Other organizations within the Department of Defense provided information on alternatives to 47 percent of the Program Directors actively searching for substitutes. These organizations included the Center Environmental Management and Civil Engineering Directorates, the Engineering Directorate at Headquarters AFMC, the Navy, and the Aerospace Guidance and Munitions Center (AGMC), located at Newark Air Force Station. Although not part of the DoD, NASA was mentioned as one source for information on an aerospace program.

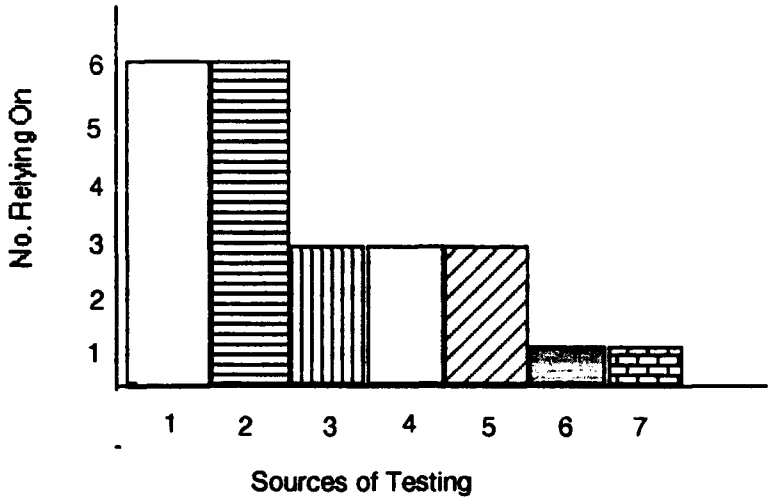
Forty percent of the Program Directors searching for alternatives turned to the EPA for information. Although the EPA published a list of potential or suggested alternatives, the Program Directors cautioned that an EPA approved alternative does not necessarily mean that the Air Force will approve the

substitute or that the alternative will prove to be a feasible solution given unique program performance requirements.

Although just 27 percent indicated that they turned to other Air Force program offices for information, this figure may change in the future. Within the last six months, most Centers had formed Product Area Committees (PACs) which were created to provide a cooperative front for confronting environmental issues. The committees were formed on the basis of program function and were envisioned to ultimately serve as a research and dissemination forum for problems common to particular types of systems.

As mentioned previously, the DoD labs had been serving a vital role in research of alternatives for Air Force specific problems. In particular, Wright Laboratory was working on a substitute for Halon 1301, Tyndall Air Force base was researching potential alternatives for Halon 1211. Naval labs had also provided data to a joint Navy/Air Force program office.

A certain degree of cooperation was also taking place in the efforts to test potential alternatives to ODCs. However, there appeared to be a great deal of variance in the sources that Program Directors were turning to for test results and the degree of dissemination that took place with those test results. While some Program Directors were looking outside of their organizations to contractors or government labs for test results of identified alternatives, many were not relying on the data generated by industry, cooperative entities, and other government agencies. Sources of test results are depicted by the following figure.



Sources of Testing:

1 - Contractors
2 - Government Labs
3 - Commercial Entities
4 - Other Agencies
5 - Unknown
6 - Program Office
7 - Depots

Figure 7. Sources of Testing Results

Several Program Directors qualified the massive amount of data that was available from a tremendous number of sources. They cautioned that before any substitutions could be made, extensive testing had to be conducted to determine if the alternatives would fit their particular situation. Aside from the research and testing that must be conducted, other factors contributed to a slow substitution process. Those cited were lack of funding and uncertainty on the extent of ODC usage on particular programs.

Investigative Question Six: If Program Directors Had Determined that ODCs Contributed to a Critical Mission Need, What was Their Long Term Plan for Acquiring the Chemicals?

What were the future issues facing Program Directors as they attempted to meet programmatic milestones while simultaneously adhering to the requirements to eliminate ODCs from their acquisition systems? Will the commercial availability of ODCs decrease to a point where substitutions may be prematurely forced or will the taxes imposed on ODCs cause future prices to be prohibitive?

Fifty-seven percent of the Program Directors whose programs utilized ODCs reported that current suppliers or contractors had informed them that they would no longer be able to supply particular ODCs, or that the cost to obtain these chemicals would be prohibitive. Certain states already had banned the use of some ODCs, thereby impacting contractors operating within those states.

Evidently the eventual depletion of supplies affected all major uses of ODCs in acquisition programs. Program Directors had been told that their supply would diminish and cost would increase for both CFCs and Freon over the next few years. A study conducted by the Navy brought out the fact that Freon F-114 was produced by only four manufacturers in the U.S. The first, DuPont, was planning to phaseout production in December 1994; the other three (Allied Signal, Ahochem, and Laroche) would phaseout production in December 1995, as required by Federal mandate. Programs which relied on Halons for fire suppression were faced with an immediate production phaseout.

Twenty percent of the Program Directors faced with reliance on ODCs indicated that shelf-life of an ODC was an issue with the supply or projected

availability of ODCs. Of the 20 percent, 66 percent indicated that they had no supply contingency plan at present. The remaining 34 percent knew that shelf-life was an issue and they had initiated a study which was underway to examine the issue and define any potential concerns.

Several Program Directors were optimistic that substitutions would be found before supply was an issue; others had determined that their programs would be phased out of operations before ODCs were totally banned.

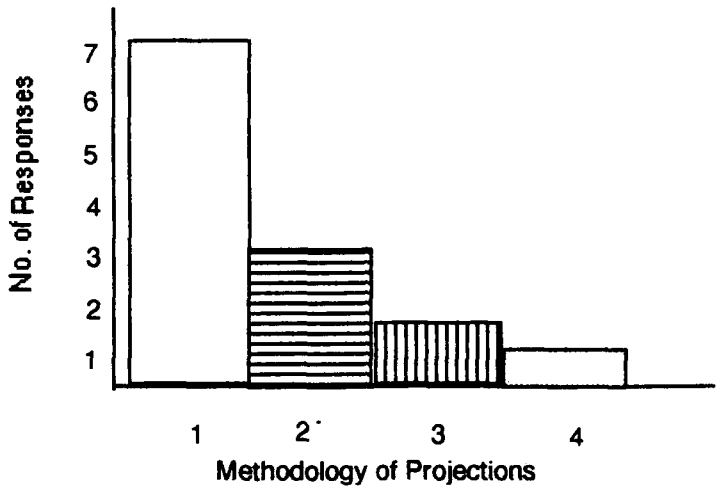
For those faced with a long term requirement and dependence on ODCs (forty percent), what was their plan to obtain the chemicals?

Sixty-three percent planned to rely on the Defense Logistics Agency's (DLA) ODC Bank (all aircraft programs for the chemical Halon); 13 percent were aware that the Air Force currently maintained a large stockpile of Halon 1301 which could be drawn from; 25 percent had removed and stockpiled all supplies of Halon 1301 which would only be drawn upon in a combat situation, while one program was considering applying for an "Essential Use" exemption to the Montreal Protocol.

Of the programs which had classified the use of an ODC as "Mission Critical" to the performance of their system, 50 percent acknowledged that they were relying on the DLA Bank. Only 20 percent of all Program Directors said they were planning to turn in excess ODCs to the DLA Bank; ten percent were unsure.

Investigative Question Seven: What Data Collection Methodologies had Program Directors Been Using to Project Future Requirements for ODCs?

By far, the greatest measure employed by Program Directors to project future requirements were internal engineering estimates. Figure 8 depicts this as well as other methodologies employed.



Methodology of Projections:
1 - Internal Program/Engineering Estimates
2 - No Method Used to Date
3 - Air Force Metric
4 - Contractor Projections

Figure 8. Methodology of Projections

The Program Directors that indicated they had no particular method to estimate projected requirements of ODCs stated that they were struggling with the reporting requirements. They had been told to base projected usage on past usage but were concerned that this basis was not necessarily a valid indicator of future usage, especially if an acquisition program was in the design or production phase.

From the results of the survey, it was concluded that the primary means to report to higher levels of management on the issue of ODCs was the report and

metric required by SAF/AQ and channeled through Headquarters AFMC in accordance with Air Force Policy 93M-011. Only one Program Director indicated that in addition to the metrics required by the Air Force policy, they had developed an internal metric which gave them more insight into the specific usages and ODCs on their program.

Occasionally, Program Directors had been tasked to provide additional information on ODCs from either Headquarters AFMC or in conjunction with program reviews by PEOs, but in general, they were not being overly tasked to provide reams of data to multiple sources.

Conclusion

This chapter began by examining the sample selected for data collection and the demographics of that sample. The findings relative to each investigative question were then presented.

Conclusions from the findings will be presented in Chapter V along with recommendations for implementation of future environmental initiatives. Chapter V will also document suggested future areas of research that came to light during this research project.

V. Conclusion

Chapter Overview

The specific findings associated with this research effort were contained in Chapter IV. Chapter V sets forth general conclusions based on the findings and recommendations for completing the initiative to eliminate the Air Force dependence on Ozone Depleting Chemicals (ODCs). In many cases, the recommendations may be applied to future environmental initiatives which might affect acquisition programs. To do this, Chapter V will first address conclusions based upon four different research areas: information distribution, tools and knowledge available to Program Directors; status of efforts to eliminate ODCs; degree of cooperation that took place to identify and eliminate ODCs; and a look at the long term plan to comply with ODC eliminating requirements. Combined with the conclusions will also be recommendations to comply with future environmental initiatives based upon lessons learned discovered during this research project. The chapter will conclude with suggestions for future research topics that were raised during interviews with Program Directors.

Research Conclusions

The legislation containing the requirements to eliminate ODCs from DoD programs has been in effect for over one and a half years; Air Force policy has been issued; goals have been established to eliminate ODCs from acquisition programs. Does this indicate success has been achieved? Not necessarily; in many cases, the goals that were established have not been met; deadlines that were set have passed; and programs are still depending upon the incorporation

of ODCs, either as an end product or in processes, to complete their missions. Eliminating ODCs from major acquisition Air Force programs has not been an easy task. While on paper the task may seem simple, actual implementation has proven quite challenging. In many cases, alternatives have been identified, but the substitution process may not be one of simply "dropping-in" the alternative. Extensive testing must be completed to assure that the substitutes will not adversely affect the often stringent performance requirements set forth in Air Force program documents. In addition to the extensive testing requirements, the entire process to eliminate ODCs has required substantial investments of time and money, as well as knowledge, communication and cooperation.

Through the survey process, it was discovered that 70 percent of the Air Force's major acquisition programs integrated ODCs either into an end product or through a process. The most significant substances and uses for ODCs were Chloroflurocarbons (CFCs) used as cleaning solvents and Halons for fire protection purposes. The importance of Halon was accentuated by the fact that it was the primary reason Program Directors classified their reliance on ODCs as critical.

The process of identifying and eliminating ODCs has had a significant impact on the financial, contractual, operations and support, and manufacturing aspects of program management. Through the entire process of complying with ODC elimination requirements, contractors have played a significant role by augmenting the staffs of the program offices. Program Directors have relied on contractors for various reasons: their personnel may not have the time or knowledge required to complete the task; the contractors in several instances, had taken a proactive approach to identifying and eliminating ODCs, thereby

benefiting the Air Force; or the contractor could complete the task faster or more accurately.

Available Information, Tools, and Knowledge. The Program Directors who had advanced knowledge of the ODC situation were better prepared once legislated requirements were established. In several programs, ODCs had virtually been eliminated by the time the FY93 National Defense Authorization Act (NDAA) was passed. The remaining Program Directors considered the quality of distributed information on ODCs to be sufficient to meet their needs, but there was a general consensus that an overall proactive approach would have been to their benefit in the long run. The window between the passing of the legislation and the date by which contracting actions could not require ODCs was less than nine months. During this time period, a flurry of activity resulted in the issuance of a substantial number of policies from different sources, and a slew of questions and clarifications between Air Staff, Headquarters Air Force Material Command (AFMC), and the Product Centers. Program Directors were forced to make decisions and set their courses on the basis of unclear or incomplete information.

The lesson learned from these findings is that a proactive approach to tracking forthcoming environmental legislation that may impact acquisition programs would ultimately benefit the Program Directors. The requirement to cease dependence on ODCs will not be the last legislation to affect the defense acquisition business. Advanced knowledge and information would allow decisions to be made at a point in the programs that might, in the long run, lessen the financial impact of compliance, as well as the manufacturing, and operations and support phases. Advanced information would allow the

Program Directors to more effectively manage their programs with a sensitivity towards environmental initiatives rather than being forced to plan a defensive campaign after the fact.

An analysis of a Naval Air Systems Program, the Harpoon/SLAM program, resulted in a similar conclusion. The researchers concluded that it is imperative for agencies and contractors to track potential environmental laws and policies very closely and disseminate information in a timely manner to program offices. This proactive approach would allow the Program Directors to take upfront actions and posture their programs for quicker and smoother actions once the actual law or policy went into effect. McDonnell Douglas Aerospace-Tactical Aircraft and Missile Systems (MDA) division was credited with having adapted this proactive approach to facilitate upcoming environmental regulations. MDA's Environmental Assurance Division is responsible for preparing an environmental strategic plan that addresses existing and upcoming environmental laws and regulations. Their plan addresses potential changes required to comply with laws or regulations, the impacts to their product lines, and establishes milestones that must be completed in order to comply with the law or regulation deadlines. The strategic plan is distributed to the program teams to allow them to understand forthcoming environmental initiatives and to guide their programs into a position to successfully comply (Hyde and Woods, 1994: 16).

In addition to a proactive approach, the entire processing of complying with environmental mandates would be enhanced if all information and requirements stemmed from a single focal point. In the case of ODCs, policy and guidance was issued from multiple organizations within the Air Force and Material Command, each adding their own interpretation or establishing their

own twist to compliance requirements. Program Directors were inundated with duplicative and often times, conflicting guidance. In the future, they would be better served if all organizations coordinated on policy and directives but only one organization, perhaps even at the DoD level, was established as the focal point with the authority to issue guidance.

Actual implementation and operational guidelines should also be established, in addition to the "awareness" information that is disseminated. It was important for the Program Directors to understand the history behind ozone depletion and the sequence of events which lead to the language in the FY93 NDAA, but they would have been better served by procedural directions that told them how to eliminate ODCs from their programs, given the parameters of deadlines and funding constraints. By establishing these requirements and procedures at a very high level, each Program Director would be exempted from the effort required to explore and weigh alternatives, and the entire Air Force implementation effort would be more consistent, consolidated, and uniform. In the case of ODCs, the choices made by Program Directors resulted in a variance on the degree of success in which they met deadlines and complied with requirements.

Several Program Directors attributed the confusion surrounding ODCs and establishment of unrealistic goals and deadlines to the limited knowledge possessed by the staffs of organizations where decisions were made. This perhaps should highlight the need for environmental training and education of acquisition personnel. Since in the past, attention has not been paid to environmental issues, the acquisition workforce has not been trained in this area. Perhaps this should change; as the acquisition workforce is expected to comply with environmental initiatives, a complete understanding of issues must

be obtained. Personnel versed on the impact of environmental sensitivity and cleanup will be needed at both the staff and headquarters level, as well as within the program offices. In order to completely and successfully fulfill our obligation to lessen the impact on the environment, environmental issues may have to be addressed by trained personnel serving in a dedicated position, not someone assuming the role as an additional duty.

Status of Elimination Efforts. The results of the research indicate that substantial progress has been made towards the goals established to eliminate ODCs from technical documents and to cease program's dependence on the harmful chemicals. But the task is not yet complete. Although seventy percent of the Program Directors assigned a moderate to highest priority to this task, sixty percent reported that an ODC still existed on their program as an end product, while 30 percent indicated that their program still relied on the incorporation of an ODC through a process. Why have the deadlines not been met? Program office personnel were working diligently, spending money, and applying resources to combat ODCs. Perhaps the established goals and deadlines were ambitious or unrealistic given the extent of ODC reliance in the Air Force and complications of making substitutions. In the future, this situation may be avoided by adopting a proactive approach and developing a strategic plan towards environment compliance. By analyzing the upcoming laws that will impact the acquisition workforce, a strategic plan of compliance could be established. The plan should include milestones which are based on realistic projections of time that it will actually take the Program Directors to bring their programs into compliance. This factual data should then be fed to the Congressional committees who are working on the legislation so that their final

version of the law would reflect realistic Air Force projections. This upfront analysis, and coordinated effort may preclude the need for later reporting back that deadlines could not be met because they were too ambitious given the effort actually required to bring acquisition programs into compliance.

Degree of Cooperation. The task that the Program Director faces is complicated enough even before environmental initiatives are considered. But throw in the requirements to lessen the program's impact on the environment, and the difficulty of their job is amplified. This new twist often means tradeoffs between performance requirements and environmental initiatives. Complicate these demands by limited funding, and lack of training and environmentally-versed personnel and the difficulty of their job is apparent. Realistically, the only way to successfully accomplish their mission is to rely on other organizations for a cross-flow of data.

The research disclosed that Program Directors are relying on outside organizations for information on potential substitutes and testing results, but perhaps not to the fullest extent possible. Due to the magnitude of the ODC issue, a tremendous number of organizations are involved in the research for alternatives and there are many sources to turn to for information. The Program Directors, however, do not on an individual basis have the time required to research each issue on their program and search for solutions. They must rely on cooperative efforts. Other organizations within the DoD, the EPA, other Air Force program offices, and DoD labs were all cited as sources for data. However, given this information, it was still concluded, that in many cases, each program was individually trying to search for solutions to potentially similar problems.

If the Program Directors are to benefit from the wealth of information and research that is ongoing, then information on these sources has to be made available to them. A single focal point within the Air Force should be established to provide the Program Directors with this sorely needed channel. The Environmental Management Directorate at the Aeronautical Systems Center (ASC/EM) is an example of the type of organization that is needed, at the Air Force level, rather than Product Center level. The program offices at ASC cited EM as their primary source for information on ODCs. In turn, ASC/EM stayed current on progress made by industry, the EPA, and cooperative organizations on potential solutions to problems confronting aeronautical systems. An answer to this problem may come with the establishment of the Air Force Ozone Depleting Chemical Information Focal Point (ODC IFP) located at Human Systems Center. This organization has been tasked to be the focal point for ODC information, and to develop a single, consistent data resource for the Air Force. The office was established on 15 June 1994, after the conclusion of the data collecting phase of this research project, so their contribution to Program Directors was not assessed by this project. However, an organization of this sort is precisely what is needed by the Program Directors to combat the ODC problem. This office should eliminate the requirement for each Program Director to singularly research his program's problems and attempt to stay abreast of industry and cooperative efforts. In order to be successful, though, all Program Directors must be periodically reminded of its existence and urged to utilize the resources of the ODC IFP.

Another relatively recent addition to furthering the cooperative relationship between those searching for solutions to the ODC situation is contained in Acquisition Policy 93M-011. This policy, dated 23 December

1993, among other initiatives, tasks HQ AFMC to assist Program Directors in identifying and minimizing the use of ODCs and hazardous materials from their programs. It also states that HQ AFMC will assist in the efforts to implement required changes to Technical Orders (TOs) and MILSPECs, and make the necessary investments to physically implement changes in support and operations of systems. More importantly, the policy stipulates that headquarters will combine AFMC resources to solve common problems which are identified by multiple Program Directors (Department of the Air Force, 1993: 2). All of these initiatives should further the programs' quest to completely comply with requirements to eliminate ODCs by making information available to program Directors and by also freeing up their resources (manpower and money) which in the past have had to be dedicated from already strained sources.

In the past, Program Directors have relied heavily on contractors for their assistance in identifying ODC occurrences and suggesting alternatives. There is nothing wrong with this reliance, however, because of the commonalty of ODC related problems within the Air Force, solutions could possibly be better derived from greater reliance on intragovernment results. This approach though would only be successful with open communications and a free exchange of information. The Program Directors do not always have visibility into other initiatives under way within the government. Therefore, again, it is imperative that a single focal point at a higher level in the chain of command assume the role of facilitator and assure that information is in fact disseminated.

Long Term Plan. Another area that requires management attention is the long term plan for supplying ODCs in the event that the programs are unable, for various reasons, to implement substitutes. The research uncovered the fact

that there is a certain amount of confusion over how future supplies will be obtained once production of ODCs has ceased. Some Program Directors are hedging their bets that their systems will be retired from the DoD inventory before supply is an issue. However, with the tendency now to upgrade systems and extend their lives, these Program Directors may be caught short without a realistic plan to keep their systems operational because of the nonavailability of a particular ODC. Several Air Force programs which are in the conceptual or early design phase have implemented prohibitions against the use of any ODC, either as an end product or through a process. This is a good practice and one that will benefit their programs in the long run. The same prohibition should be considered for any future upgrades or modifications to existing systems. Advanced knowledge of upcoming environmental legislation will also benefit the Program Directors so that they can act proactively and won't have to go back after the fact and spend a greater proportion of resources to eliminate the problem substances. An example of where this information might benefit the Air Force is on the issue of the EPA 17 substances which will eventually also be banned from use in acquisition programs.

Through this research effort, Halon surfaced as the primary ODC that managers are having difficulty finding a suitable replacement for. It is the primary substance that may have to be obtained from the DLA reserve if substitutes are not identified and systems are not phased out of operations prior to the cease in Halon production. From interviews conducted with the Program Directors, it was discovered that there is a great deal of confusion over how the chemicals will actually be obtained from DLA. What amounts will be available, will the amounts be limited, what will the exact procedures be to obtain the chemicals? There are also questions over whether the methods used to project

future requirements are adequate or if they need to be revised to reflect a more accurate picture.

Fortunately, the DoD has recognized the difficulties of replacing Halon and has continued to fund research initiatives through its labs. Both Wright Labs and the Air Force Engineering Services Center at Tyndall Air Force Base continue with their initiatives to find suitable, safe, reliable and economically feasible substitutes. The solutions may have to originate from within the DoD rather than with industry since certain Halons are used predominately by the DoD. Previous research concluded that DoD accounted for approximately 91 percent of Halon 1211 and 8 percent of Halon 1301 emissions to the atmosphere (Anderson and others, 1988: 487). Interestingly enough, it has been discovered that most Halon emissions do not result from actually extinguishing fires but from training, testing, servicing, and the unnecessary or accidental discharge of Halon firefighting equipment (Anderson et al, 1988: 491). Figure 9 displays the source of DoD Halon emissions.

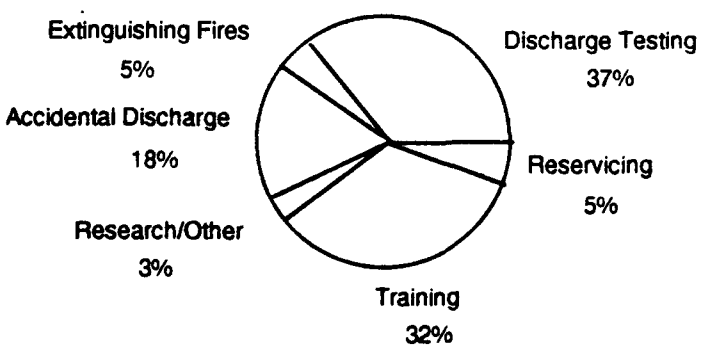


Figure 9. DoD Halon Emissions By Use Category (Anderson et al, 1988: 488)

The Army study concluded that emissions could be reduced significantly by developing stricter qualifications for operators and installers; by a more rigorous training program for personnel; by designing discharge tests to use alternative chemicals; by standardizing designs for Halon-protected space; and by designing blower doors which could accurately measure room air exchange (Anderson and others, 1988: 491). Therefore, research needs to continue to not only search for alternatives but to possibly modifying the procedures that are now used with Halon fire protection equipment. Perhaps a short term solution may not come from a substitute but from modified operating procedures and redesign of existing equipment. Whatever the solution, resources and attention from within the DoD must continue to be applied to the Halon situation. This may be one case where industry initiatives will not lead to a suitable solution since the problem is so DoD specific.

Future Research

Throughout the research project, several issues were raised which warrant further research attention and perhaps would be suitable as the basis for future thesis topics.

Training and Organizational Structure. As environmental concerns become increasingly integrated into the acquisition process for Air Force systems, the need for highly trained personnel becomes apparent. The training that acquisition personnel currently receive may not adequately allow for environmental concerns to be effectively tackled. Additional resources may have to dedicated within the program offices to handle environmental issues and these persons will have to have a fundamental knowledge of the

environment as well as an understanding of the acquisition process. This combination of knowledge, skills, and training will be the only way that environmental sensitivity can be integrated into the acquisition process.

Currently in the program office, there is no standard for a training program or for an organizational structure to address environmental concerns. Program offices have assigned environmental issues to persons serving in various capacities including engineering, manufacturing, financial, integration, product assurance, and civil engineering. Several offices have personnel dedicated to researching and solving environmental problems while in other organizations, this responsibility is assigned as an additional duty and is given attention only when issues heat up. In several of the larger programs, Program Directors have benefited from having dedicated environmental engineers matrixed to their programs from the Environmental Management Directorate. With the increased emphasis on the environment, future systems that are environmentally sound may not be capable of being effectively fielded, given the current training programs and organizational structures.

Future Environmental Legislation. As difficult as it has been, and continues to be, to eliminate dependence on ODCs, the Program Directors recognize that in many cases it will be much more difficult to rid the programs of the 17 substances that the EPA has identified as industrial toxins. A proactive approach to this environmental obstacle might preclude the need to go back after the fact and invest substantially in a cleanup program. Programs in the conceptual and design phases could integrate requirements now to eliminate dependence on these substances if more information was available. Also, upgrades and modifications to existing programs could also integrate

requirements to eliminate the substances from use. This approach will only work, however, if a coordinated, consolidated plan is instituted from high levels of management and communicated down to the Program Directors level where it could be actually implemented.

Consolidated Research. AQ Policy 93M-011 designated the Headquarters' Engineering Directorate (HQ AFMC/EN) as the Air Force ODC Waiver Focal Point, and the Science and Technology office at Headquarters AFMC (AFMC/ST) as the organization responsible for identifying common deficiencies in technology that might prohibit the drive to eliminate ODCs from acquisition programs. Is information making its way up from the program offices and being cross-fed between these two organizations? While conducting the research, many concerns with technology or specific uses of ODCs were repetitively raised and it seemed only appropriate that they could be solved through a cooperative effort. The AFMC Technology Master Plan Process, headed up by AFMC/ST, would seem to be an ideal forum for capturing common problems and working to find and fund feasible solutions. Research should be done to ensure that the process is working as intended; that information is flowing from the program level through EN to ST, out to research facilities, and back again to the requirements initiator.

Final Thoughts

The Air Force has indicated that it wants to be the leader within the DoD on environmental initiatives. Within the acquisition community, many initiatives have been implemented to ensure that we do step up to meet the demands generated by an increased emphasis on developing programs that are

environmentally sensitive. The only feasible solution, however, will be to develop a strategic plan that involves working with Congress on legislation and requirements, and becoming involved in cooperative arrangements with other DoD organizations, Federal agencies, industry, and cooperative organizations to search for feasible solutions and combine research efforts. A study sponsored by the Army in 1991 concluded that for every dollar spent to procure a hazardous material, eight to ten dollars are required for handling and disposal (Morehouse, 1991: 1). In a time of a decreasing defense budget, the emphasis on a intelligent approach to environmental compliance must be adopted. The author of the Army study stated that, "Preoccupation with performance needs to be tempered to include environmental performance as a consideration" (Morehouse, 1991: 2). Unfortunately this may be the only alternative that is available as we struggle to field new systems but grow to be more concerned with their potential to adversely impact the environment. An overall environmental strategic plan would help to assure that environmental performance is designed in early in the life cycle of a program where trade-offs could be assessed and balanced, and impacts minimized. This is the only alternative if the Air Force continues to aspire to fielding effective systems while still being stewards of environment.

Appendix A: Class I Ozone Depleting Chemicals

Halocarbon Number	Ozone Depletion Potential
Group I	
CFC-11	1.0
CFC-12	1.0
CFC-113	0.8
CFC-114	1.0
CFC-115	0.6
Group II	
Halon-1011 (USAF Restricted)	Unknown
Halon-1202 (USAF Restricted)	Unknown
Halon-1211	3.0
Halon-1301	10.0
Halon-2402	6.0
Group III	
CFC-13	1.0
CFC-111	1.0
CFC-112	1.0
CFC-211	1.0
CFC-212	1.0
CFC-213	1.0
CFC-214	1.0
CFC-215	1.0
CFC-216	1.0
CFC-217	1.0
Group IV	
Carbon Tetrachloride	1.1
Group V	
Methyl Bromide	Unknown
Methyl Chloroform	.1

(Department of the Air Force, AFR 19-15, 1991:12)

Appendix B: Typical Air Force End Uses For Substances That Deplete Stratospheric Ozone

Typical End Uses	Substances Used
Cooling aircraft and missile crew compartments, offices, Residential areas and electrical component areas	CFC-11 FC-12
Fire protection on board all aircraft and in electrical component areas	Halon 1211 Halon 1301
Process or special application refrigeration, including aircraft electronic countermeasures targeting, avionics, and other speciality pods and equipment	CFC-11 CFC-12 CFC-114 CFC-115 CFC-500 CFC-502
Rigid and flexible foams used as insulation in facilities, crew compartments, weapons systems, and for packaging	CFC-11 CFC-12 CFC-114
Solvent cleaning of optical surfaces, hydraulic control systems, navigation and guidance systems, circuit boards, and liquid oxygen equipment	CFC-113 Methyl Chloroform Carbon Tetrachloride
Hospital equipment sterilization	CFC-12
Rocket motor thrust control devices	Halon 2402

(Department of the Air Force, AFR 19-15, 1991: 3-4)

Appendix C: Goals for Reducing Ozone-Depleting Chemical Releases, Procurements, and Use

	DoD's Milestones				
Category	Institute plans to reduce necessary releases during operation, maintenance and training	Institute plans to eliminate procurement and use	Stop use in new procurement	Phaseout of current applications to 50 percent of 1986 levels	Reduce use in all applications to zero
CFCs					
Nonessential	October 1990*	January 1992	January 1993	January 1993	January 1994
Mission Essential	October 1990*	January 1993	January 1994	January 1995	January 1996
Mission Critical	October 1990*	January 1994	January 1996	January 1998	January 2000
Halons					
Nonessential	October 1990*	October 1990*	October 1990*	Not available	January 1994
Mission Essential	October 1990*	October 1990*	October 1990*	January 1993	January 1996
Mission Critical	October 1990*	October 1990*	January 1995*	January 1997	January 2000
Methyl Chloroform					
Nonessential	January 1992	January 1992	January 1993	Not available	January 1993
Mission Essential	January 1992	January 1992	January 1993	January 1994	January 1995
Mission Critical	January 1992	January 1994	January 1995	January 1996	January 2002
Carbon Tetrachloride					
Nonessential	January 1992	January 1992	January 1993	Not available	January 1993
Mission Essential	January 1992	January 1992	January 1993	January 1995	January 1996
Mission Critical	January 1992	January 1994	January 1995	January 1995	January 2000
HCFCs					
Nonessential	January 1992	Not available	Not available	Not available	Not available
Mission Essential	January 1992	Not available	Not available	Not available	Not available
Mission Critical	January 1992	Not available	Not available	Not available	January 2015

(US GAO, 1991: 16)

*With noted exceptions, the Air Force milestones for ODC reductions are identical to those presented in the above chart. The exceptions are captured in the following table:

Air Force's Milestones

Category	Institute plans to reduce necessary releases during operation, maintenance, and training	Institute plans to eliminate procurement and use	Stop use in new procurement	Phaseout of current applications to 50 percent of 1986 levels	Reduce use in all applications to zero
CFCs					
Nonessential	October 1991				
Mission Essential	October 1991				
Mission Critical	October 1991				
Halons					
Nonessential	October 1991	October 1991	October 1991		
Mission Essential	October 1991	October 1991	January 1993		
Mission Critical	October 1991	October 1991	January 1997		

(Department of the Air Force, AFR 19-15, 1991:5-6)

Appendix D: Survey Instrument

29 Apr 94

MEMORANDUM FOR
ATTENTION:

FROM: HQ AFMC/PK
4375 Chidlaw Rd, Suite 6
Wright-Patterson AFB OH 45433-5006

SUBJECT: Survey on the Impact of Ozone Depleting Chemicals (ODCs) on the Acquisition Process

1. Title III, Section 326 of the National Defense Authorization Act for FY 93 established the requirement to eliminate Ozone Depleting Chemicals within the Department of Defense. For the last year and a half, managers within the DoD have been challenged to implement this complex legislation and the associated regulations and policies. The issues relating to ODCs will certainly not be the last environmental initiative that the DoD must comply with.

2. In an effort to evaluate the effectiveness with which we, as a Command, have implemented procedures to eliminate ODCs, the AFMC Directorate of Contracting is sponsoring a telephonic survey-based research project in conjunction with the Air Force Institute of Technology (AFIT), Graduate School of Logistics and Acquisition Management. Ideally, the information gained through this research will help to measure the status of our compliance to date, identify any variables which may be hindering full compliance, and provide us with lessons learned which may be applicable to the implementation of future environmental initiatives.

3. As the Program Director of the _____ program, your knowledge and expertise are critical to the success of this research project. You are a member of a carefully selected group of individuals and we are very interested in obtaining your thoughts on issues surrounding the implementation of the ODC legislation and policies.

4. Enclosed is an advanced copy of the telephonic survey. Within the next week, Ms Susan Willard, an AFIT Graduate Research Student, will be contacting you to schedule a convenient time to conduct the actual telephone survey. It is expected that the actual survey will take 20 - 30 minutes of your time. The advanced copy of the survey is being provided so that you may become familiar with the questions, and to also provide you with an opportunity to conduct any reviews that may be necessary prior to the actual telephone survey.

5. Your help in completing this research project will make a real contribution to our ability to assess and comply with this particular environmental issue, and perhaps future issues. Be assured that your reply will be treated in strict confidence and will remain anonymous. Should you be interested in the results of this research project, a copy will be mailed to you. Thank you in advance for your cooperation and participation. If you have any questions, please feel free to call Ms Willard at DSN 785-7777, ext 2399 or myself at DSN 787-3882.

TIMOTHY P. MALISHENKO, Colonel, USAF
Director of Contracting

Attachment:
Survey

SURVEY ON THE IMPACT OF OZONE DEPLETING CHEMICALS (ODCs) ON THE ACQUISITION PROCESS

The purpose of this survey is to obtain information to assess the status of the Air Force's ability to comply with Ozone Depleting Chemicals (ODC) legislation and define variables that may be prohibiting full compliance with this environmental initiative.

The following questions will be discussed during an upcoming telephone survey. Please take a few moments to review the questions and become familiar with the content of the survey. It may be helpful to conduct any research within your Program Office prior to the time of the survey.

SECTION 1 - GENERAL ISSUES.

1-1. Please rate the usefulness of information distributed within the DoD which describes the extent of the ODC problem and the expectations to reduce/eliminate reliance on the substances.

As a Program Director required to eliminate ODCs from my program, the information has been...

1	2	3	4	5	6
very inadequate	inadequate	somewhat inadequate	somewhat adequate	adequate	very adequate

Comments?

1-2. Before the FY93 National Defense Authorization Act was passed (the driving legislation for the current ODC policy) was there any concern on your particular program to reduce or eliminate reliance on ODCs during the system's life cycle?

1-3. Prior to the passing of the legislation and issuance of policy letters, were ODCs or the use of ODCs important to the successful completion of your program?

1-4. Does the requirement for the ODC as an end product still exist on your program today?

1-5. As of today, does the success of your program rely on the incorporation of an ODC through a process?

1-6. Rate the level of support your Program has received from higher levels of management to reduce/eliminate ODCs from your program?

1	2	3	4	5	6
very unsupportive	unsupportive	somewhat unsupportive	somewhat supportive	supportive	very supportive

Comments?

1-7. Rate the overall priority level, from a managerial perspective, that the reduction/elimination of ODCs has been given on your program within the last year and a half (Priority to include allocation of resources, time, importance in relation to other program concerns).

1	2	3	4
No Priority	Low Priority	Moderate Priority	Highest Priority

Comments?

1-8. Has the requirement to reduce/eliminate ODCs impacted any of the following aspects of your program, and if so how? Please rank, from greatest to least, the impact to the different aspects.

a. Financial
b. Contractual
c. Technology
d. Performance Requirements
e. Schedule
f. Subcontracting
g. Manufacturing Processes
h. Operations and Support

SECTION 2 - IDENTIFICATION/CLASSIFICATION ISSUES

2-1. How could the uses of ODCs be categorized on your program? (Multiple choices may apply)

a. Cleaning Solvents
b. Fire Protection
c. Cooling
d. Painting/Depainting
e. Other

2-2. The Clean Air Act contains the following definitions:

Mission Critical: Has a direct impact on the combat mission capability. Use is integral to combined mission assets or affects the operability of assets.

Mission Essential: Has an indirect effect on the mission and plays an auxiliary role in the operability of assets.

Nonessential: All other uses.

How has the use of ODCs on your program been classified (as defined by the Clean Air Act) with regard to the overall success of your program?

a. Mission Critical
b. Mission Essential
c. Nonessential

2-3. How are the ODCs on your program classified?

Class I a. Halons
b. Chloroflurocarbons (CFCs)
c. Carbon Tetrachloride
d. Methyl Chloroform
e. Methyl Bromide

Class II a. Hydrochloroflurocarbons (HCFCs)

SECTION 3 - TECHNICAL DOCUMENTS (Technical Documents include but are not limited to MILSPECS, Standards, Technical Orders, and Program Specific Technical Documents)

3-1. Are you aware of any Air Force or DoD-wide cooperative efforts to screen technical documents (not including program specific documents), and if so, has your program benefited from these searches?

3-2. What, if any, has been the level of involvement from your Program Office to support the searches referenced in question 3-1?

3-3. What is the status within your Program Office of reviewing and revising program specific technical documents to eliminate the requirement for ODCs?

3-4. What methods are being used to identify the requirement for ODCs in program specific technical documents?

3-5. Has a contractor participated in the exercise of identifying ODCs in technical documents and if so, was their involvement voluntary or required by the Government?

3-6. What is the estimated cost incurred to date to complete this process and what costs are expected to be incurred in the future?

3-7. How much time has been invested in this process and what is the amount of time projected to be required to complete this project?

3-8. Describe your efforts to coordinate the search for suitable substitutes of ODCs with other services, defense contractors, private industry, labs, Air Force Program Managers, etc.

SECTION 4 - ALTERNATIVE MATERIAL/PROCESS TECHNOLOGY

4-1. Are you aware if any alternative material or processes have been identified that would allow for the elimination of ODCs on your program?

4-2. In your opinion are any alternative material or processes currently commercially available, and are they economically feasible?

4-3. What type of testing, either internal or external, are you aware of that the alternatives have undergone and are the test results readily available to other organizations?

4-4. For the known alternatives, are you aware of the Ozone Depleting Potential (ODP) factor and is it less than that of the ODC currently being relied upon?

4-5. Are you aware if any of the alternatives are classified as "Hydrochlorofluorcarbons"?

4-6. Have substitutions to ODC processes/materials been made on your program? If so, did the alternatives affect any of the following aspects of your program, and if so, how? Please rank, from greatest to least, the impact to the different aspects.

a. Financial
b. Performance Requirements
c. Contractual
d. Schedule
e. Warranties
f. Subcontracting
g. Manufacturing Processes
h. Operations and Support

4-7. Are you aware if any of the following organizations have approved alternative materials or processes for uses similar to those for which your program may be using ODCs? Please explain.

a. Environmental Protection Agency (EPA)
b. other organizations within the Department of Defense
c. other Air Force programs offices
d. any of the DoD labs
e. other (commercial or defense contractors, industry labs, associations/societies)

4-8. Is your Program Office pursuing any research and development efforts to discover substitutes for ODCs used on your program? If the answer is yes, do the R&D efforts involve any of the following?

a. Other Program Offices
b. Contractors
c. Government labs
d. Other

4-9. Are you aware of any Air Force or DoD-wide efforts to coordinate the search for suitable ODC substitutes with the other services, defense contractors, and/or private industry and, if so, have you benefited from these searches?

SECTION 5 - REPORTING AND SUPPLY ISSUES

5-1. Have you been informed by current suppliers or contractors that either they will no longer be able to supply particular ODCs or that the cost of supplying ODCs will be substantially higher?

5-2. If substitutes are not available or are not economically feasible, what is the long term plan to supply ODCs for your program?

5-3. If ODCs have not been eliminated from your program, what methodology is being used to project the expected ODC requirements for the Program's life cycle?

5-4. If the use of an ODC has been classified as "Mission Critical" to the performance of your system, are you planning to obtain supplies from the Defense Reserve (ODC Bank) managed by the Defense Logistics Agency (DLA)?

5-5. Are you planning to turn in any excess ODCs to the Defense Reserve?

5-6. Is the shelf-life of the ODCs an issue with the supply or projected availability and if so what are the contingency plans?

5-7. Is there a particular metric being used within your Program Office to track the ODC requirements?

5-8. What, if any, reporting mechanism is currently in place to report to higher levels of management on the projected ODC requirements, and how often is that information processed?

SECTION 6 - DEMOGRAPHIC INFORMATION

6-1. How long have you been assigned to this particular program as the Program Director?

6-2. What phase of the acquisition cycle is your program currently in?

6-3. Describe the sources from which you have received information on the ODC issue. (Multiple choices may apply)

a. Official briefings
b. Formal courses
c. Official correspondence
d. AFMC video
e. Personal reading
f. Other

6-4. Are you interested in receiving a copy of the final report?

Appendix E: Data Analysis

DEMOGRAPHICS

Program Info:

sample included 20 major programs assigned to PEOs (total population of 33; therefore sample represented 61% of total population)

10 Aircraft programs (10 in pop; 100% of total population)
10 Non-Aircraft programs (23 in pop; 43% of total population)
programs included satellite, missile, info management systems, FMS

program acquisition stage (Note: this number does not total to 20; many programs reported that they are in multiple acquisition phases. For instance, the primary aircraft may be in operation, while an upgraded version is in production and perhaps an electronics system is in EMD):

Concept Exploration: 0
Demonstration/validation: 2 total: A/C - 1, Non- A/C - 1
Engineering Manufacturing Development: 8 total: A/C - 5, Non-A/C - 3
Production: 11 total: A/C - 7, Non-A/C - 4
Operations and Support: 10 total: A/C - 5, Non-A/C - 5

Length of time on program:

System Program Director:

0 - 1 years: 8 total (40%): A/C - 4, Non-A/C - 4
1+ - 3 years: 9 total (45%): A/C - 4, Non-A/C - 5
3+ - 5 years: 2 total (10%): A/C - 2, Non-A/C -0
over 5 years: 1 total (5%): A/C - 0, Non-A/C - 1

Participants:

System Program Director: 2 total (10%): A/C - 1, Non-A/C - 1
Deputy System Program Director: 2 total (10%): A/C - 2, Non-A/C - 0
Pollution Prevention Focal Point: 16 total (80%): A/C - 7, Non-A/C - 9

SECTION 1 - GENERAL ISSUES

1-1. Please rate the usefulness of information distributed within the DoD which describes the extent of the ODC problem and the expectations to *reduce/eliminate reliance on the substances.*

As a Program Director required to eliminate ODCs from my program, the information has been...

1	2	3	4	5	6
very inadequate	inadequate	somewhat inadequate	somewhat adequate	adequate	very adequate

Comments?

1-very inadequate: 0 total
2-inadequate: 2 total (10%): A/C - 2, Non-A/C - 0
3-somewhat inadequate: 4 total (20%): A/C - 2, Non-A/C - 2
4-somewhat adequate: 8 total (40%): A/C - 3, Non-A/C - 5
5-adequate: 5 total (25%): A/C - 3, Non-A/C - 2
6-very adequate: 1 total (5%): A/C - 0, Non-A/C - 1

Lack of real understanding of issue

- The ODC policy vacillates reflecting a lack of real understanding for a long term plan.
- No one initially knew how to implement required changes, generating lots of confusion (ex. waiver policy was not issued until mid-July 93).
- Lots of confusion at the beginning; Gen McPeak's direction took an excessive amount of time to be issued.
- The initial information was inadequate. Just been in the last 6 months that data and guidance has caught up with real situation.

Inconsistent Priorities

- Policy and distributed information reflects changing priorities and who is screaming loudest.
- Expectation to eliminate reliance on ODCs is clear, however, priorities to eliminate is confusing.
- Much confusion among upper management as to the required changes and how to implement.
- We were given enough info on the extent of the problem but lacking on expectations to reduce/eliminate.
- Plan to eliminate was not consistent with good management practices - lots of confusion, on clear direction, no $ to implement.
- Language in guidance was geared to Aircraft programs and therefore difficult to apply to space or other programs.

Unrealistic Suspenses

- Suspenses to act upon were too short.
- Compressed schedule was unrealistic.
- High expectations to meet deadline.
- Not even given time to budget money in POM cycle to meet deadlines.

Lack of funding

- No funding to implement
- Congress source of much of confusion. They established requirements to eliminate but did not provide program manager with money to implement the changes or direction on how-to make the changes.

Lack of "How-to's"

- Lots of data was issued on the extent of the problem but not a lot of guidance on how to solve the problem.
- Information was adequate in terms of the need and impact of the problem, however it has been lacking in "how-to's" to solve the problem.
- Law was received but implementation instruction has been lacking.
- Message was clear on intent to reduce reliance on ODCs but how-to's was not included.

Duplication of Information

- Gobs of information was issued, often same correspondence is received multiple times.
- Information was very adequate but often times duplicative of information previously received from the same or different sources.

Too much information, too many sources involved

- All that was needed was the national Defense Authorization Act of FY93, Sections 325 and 326, AF Acquisition Circular 92-29, the Eleanor Spector 21 May 93 letter which included DFARS 210.002-71, the two AF Policy letters, waiver format, and law (Executive Order #12856, Title III - Emergency Planning and Community Right To Know Act of 1986, 40 CFR Part 82). All other information issued on the subject has been of questionable value.
- Information has been received from a number of sources, all containing a different spin. Policy at the top is clear but as it goes through communication channels and gets interpreted it gets muddied, confusing and often conflicts with previously issued guidance.
- Lots of different inputs and changes required from various sources.

ODCs Irrelevant

- Since particular program is an information system, ODCs are not an issue yet they continued to receive all the data, many times multiple copies of data. Were forced to review only to find time was wasted since data was not relevant. Information or distribution should be tailored instead of being sent in a shot-gun fashion.
- ODCs were not an issue on our program yet continued to receive gobs of data. Info should be screened.
- Adequate but not totally relevant in all cases (program was based on NDIs).

Info concise and direct

- The guidance to eliminate ODCs has been concise and direct. That is in marked contrast to the confusing and at times conflicting guidance that has been provided on other pollution related topics. Program Directors can effectively react when we know what is expected and why.

1-2. Before the FY93 National Defense Authorization Act was passed (the driving legislation for the current ODC policy) was there any concern on your particular program to reduce or eliminate reliance on ODCs during the system's life cycle?

No: 10 total (50%): A/C - 5, Non-A/C - 5
Yes: 10 total (50%): A/C - 5, Non-A/C - 5

No Concern

- Knew that Government did not require use of ODCs on program; vendors may have been using ODCs in processes but at their own discretion. Didn't feel that ODCs were a big issue on their program.
- No concern as evidenced by amount of usage. In 1992 15,357 lbs of ODCs were used in depot level repair activity versus 4,416 lbs in CY1993.
- Were aware that in future, ODCs would be an issue but since precise guidance had not been issued, they were unable to plan, react, plot a course.
- Did not become a Program office until 1993.
- Fielded FMS program, couldn't react because they didn't know how policies would relate to their situation.
- Information system - ODCs not an issue.

Concern

- Knew that use of Halon 1301 for fire suppression was a problem; had begun working with Wright Labs to find a replacement . At that point in time, not concerned with other ODCs.
- Started working reduction/elimination as early as 1988; by time the law was passed, program had eliminated reliance on most ODCs.
- At time of contract award in March 1991, were aware of future requirements to eliminate ODCs and incorporated this requirement on contract. ODCs were part of Hazardous Priority List that went on contract.
- Had on contract requirement to reduce all hazardous materials (not ODCs in particular).
- Program office making efforts to identify ODC usage as early as 1989.
- Aware of problems with ODCs, had started in 1989 working to find substitutes for solvents.
- Actions triggered by Clean Air Act, heavy reliance on contractor; at time act was passed - program was 98% ODC free

Impetus from State Laws

- Stricter state law was only reason for earlier action.
- Contractor was located in California and was forced to comply with more strict state laws .
- Contractor had to comply with Texas EPA requirements at their plant which forced earlier elimination of ODCs than national law requirements.

1-3. Prior to the passing of the legislation and issuance of policy letters, were ODCs or the use of ODCs important to the successful completion of your program?

No: 6 total (30%): A/C - 1, Non-A/C - 5
Yes: 14 total (70%): A/C - 9, Non-A/C - 5

No

- Still in conceptual/design phase.
- Information system
- Primarily an NDI program

Yes

- Fire suppression specifically called out
- Use as solvents/cleaners specifically called out
- Use as paint strippers specifically called out
- Use as cooling specifically called out

1-4. Does the requirement for the ODC as an end product still exist on your program today?

No: 8 total (40%): A/C - 2, Non-A/C - 6
Yes: 12 total (60%): A/C - 8, Non-A/C - 4

No

- Still in design phase
- Information system
- NDI program

Yes

- Primarily as a fire suppressant but also in other minor uses
- ECP is currently in process to eliminate freon in the refrigerant system
- Halon has been removed from the ground-based simulator; no substitute was made
- Even though technological solutions are available, existing aircraft system redesign and modification will cost millions of dollars and take years to complete
- One program reports they are 98% ODC free now because they started working the issue in 1989

1-5. As of today, does the success of your program rely on the incorporation of an ODC through a process?

No: 13 total (65%): A/C - 7, Non-A/C - 6
Yes: 6 total (30%): A/C - 2, Non-A/C - 4
Unknown: 1 total (5%): A/C - 1, Non-A/C - 0

No

- Still in design phase
- Information system
- NDI program

Yes

- ODCs still being used for cleanings/solvents
  (no substitute identified for oxygen masks
  if changes are made at this stage of the program, products/processes will have to be requalified which will take time, resources, and money

1-6. Rate the level of support your Program has received from higher levels of management to reduce/eliminate ODCs from your program?

1	2	3	4	5	6
very unsupportive	unsupportive	somewhat unsupportive	somewhat supportive	supportive	very supportive

Comments?

1-very unsupportive: 0 total
2-unsupportive: 1 total (5%): A/C - 1, Non-A/C - 0
3-somewhat unsupportive: 2 total (10%): A/C - 2, Non A/C - 0
4-somewhat supportive: 6 total (30%): A/C - 4, Non A/C - 2
5-supportive: 6 total (30%): A/C - 2, Non A/C - 4
6-very supportive: 2 total (10%): A/C - 1, Non A/C -1
Not Applicable: 3 total (15%): A/C - 0, Non A/C - 3 (ODCs not an issue on these programs)

Supportive but no Funding

- Plenty of support on paper but limited guidance, no money, and an un-coordinated effort
- Have included $140M in budget starting in FY95 for contractor to research alternatives, test, and qualify new products to reduce ODCs. Lots of questions were raised over this amount and SPD is unsure they will receive any of the money
- PEO has not interfered except for asking for an occasional update
- PEO has not generated additional taskings for this effort; has remained a neutral body. ie - hasn't helped tremendously but hasn't gotten in the way either.
- all efforts have been forced to be funded out of hide
- We have not received additional funding to deal with the removal of ODCs but we do get approval for the tasks we must undertake to accomplish
- Finally forced to go to Center Commander with statistics on how many planes will be grounded because of the dollars which must be diverted to eliminating ODCs - have to give them information in terms that they will understand = mission impact
- massive amounts of information do provide assistance but funds are required to develop an automated requirements tracing capability to identify ODC solvent usage
- Program will soon be at the point where we'll have to trade hardware for ODC compliance.

Uncoordinated Approach

- It is a stupid approach for each program to tackle the ODC program individually with a defense contractor who has more than one defense contract where their ODC use is company-wide. Seems they are being paid over and over for the effort to eliminate ODCs. The contract management activity has not made an effort to coordinate the overall effort, therefore, all efforts are individual and uncoordinated
- No organized infrastructure has been developed to counter the problem
- Higher management has established unrealistic metrics and goals

Untrained Staffs

- Senior leaders have been poorly served by staffs that did not understand the range and scope of this effort and the time required to solve these issues

Support Provided

- The local Environmental Management Directorate has been extremely supportive and resourceful in helping to solve our problems (ASC/EM)
- Pollution Prevention Handbooks developed by HSC have been very helpful: Overview, AFMC I implementation Guide, Environmental Regulations Guide, Weapons Systems Guide, Alternatives Guide
- PEO has been very supportive but probably due to his knowledge of the program - he was the former SPD
- AFMC has been supportive but above that, the support is unclear. PEO has recently been involved in discussions of money and funding only

1-7. Rate the overall priority level, from a managerial perspective, that the reduction/elimination of ODCs has been given on your program within the last year and a half (Priority to include allocation of resources, time, importance in relation to other program concerns).

1	2	3	4
No Priority	Low Priority	Moderate Priority	Highest Priority

Comments?

1 - no priority: 1 total (5%): A/C - 0, Non A/C - 1
2 - low priority: 5 total (25%): A/C - 0, Non A/C - 5
3 - moderate priority: 8 total (40%): A/C - 7, Non A/C - 1
4 - highest priority: 6 total (30%): A/C - 3, Non A/C - 3

Low Priority

- Never has been allowed to be a show stopper
- money constraint has made issue a lower priority. Have POMed for the money but unsure when they will see it

Moderate Priority

- realized that requirements stem from a public law. Therefore have operated to comply with that law but worked in a manner to avoid shutting the program down. Fortunate because the contractor has been proactive
- Since Dec 93, we lacked a full time environmental manager until the first of April 94. Therefore, 2 engineers shared the load as additional duties and answers were not as good as they could have been. The financial issues were not attended to or considered until Jan 94
- Our managers set a high priority on solving ODC problems when they become obstacles to mission accomplishment. Overall, must still consider cost vs benefits. Identifying ODCs and finding alternative to manufacture a system already designed and in production is viewed as a lot of cost with little benefit

Highest Priority

- SPD realized sever impacts if didn't meet requirements of PL, therefore given highest priority
- SPD's attitude is "either do it right or don't do it", therefore has it given it highest priority and doing to best of ability within given constraints
- Received instructions in January then escalated to critical quickly. Until the last few months has received low priority
- Cannot award a contract without doing a waiver or certifying that we are not requiring ODCs. To do a waiver requires research and planning. This process has held up contract awards.
- Although issue has been given high priority, lots of confusion has surrounded it. It took over a year to generate the policy, yet deadlines to meet were very short. Fortunately we started early and were proactive. We have competition each year between 2 contractors and they have been very supportive and proactive. Competition has forced them to be this way
- ODCs given highest priority. ready to embark on $50M program over the next 5 years to track over 990 chemicals to the part level on their program

1-8. Has the requirement to reduce/eliminate ODCs impacted any of the following aspects of your program, and if so how? Please rank, from greatest to least, the impact to the different aspects.

a. Financial
b. Contractual
c. Technology
d. Performance Requirements
e. Schedule
f. Subcontracting
g. Manufacturing Processes
h. Operations and Support

Financial	ranked	#1 by 6 programs (A/C - 3, Non A/C - 3) #2 by 3 programs (A/C - 3, Non A/C - 0) #3 by 2 programs (A/C - 2, Non A/C - 0)
Contractual	ranked	#1 by 4 programs (A/C - 4, Non A/C - 0) #2 by 5 programs (A/C - 4, Non A/C - 1) #3 by 0 programs (A/C - 0, Non A/C - 0)
Operations and Support	ranked	#1 by 3 programs (A/C - 3, Non A/C - 0) #2 by 1 program (A/C - 1, Non A/C - 0) #3 by 3 programs (A/C - 2, Non A/C - 1)
Manufacturing Processes	ranked	#1 by 0 programs (A/C - 0, Non A/C - 0) #2 by 3 programs (A/C - 1, Non A/C - 2) #3 by 4 programs (A/C - 3, Non A/C - 0)

No Impact reported by 6 programs, all Non- A/C programs

Ranked	#1	Financial	6 programs (A/C - 3, Non A/C - 3)
		Contractual	4 programs (A/C - 4, Non A/C - 0)
		Operations & Support	3 programs (A/C - 3, Non A/C - 0)
	#2	Contractual	5 programs (A/C - 4, Non A/C - 1)
		Financial	3 programs (A/C - 3, Non A/C - 0)
		Manufacturing Processes	3 programs (A/C - 1, Non A/C - 2)
	#3	Manufacturing Processes	4 programs (A/C - 3, Non A/C - 1)
		Operations and Support	3 programs (A/C - 2, Non A/C - 1)
		Technology	3 programs (A/C - 2, Non A/C - 1)
		Financial	2 programs (A/C - 2, Non A/C - 0)

Financial

- All money has come out of existing program funds; have included $5M per year in POM for future pollution prevention efforts
- Have paid the contractor $1.2M to produce metrics tracking ODC usage back to 1992
- No money in budget or POM
- Have paid contractor to conduct a study on all Haz Mat Identification, ie - ODCs, EPA 17 + others ($2M through June 95 via a CCP)
- Our program must make 2 large investments. One is to develop and implement the most feasible alternative to mission critical coolant used for the aircraft cabin and equipment. The second will be to establish and maintain a pollution prevention program that can withstand present and future pollution compliance requirements. This will require a major overhaul of the way our configuration/data is managed . Both are unfunded/unbudgeted and could force a program restructure is funds are not found. If restructure occurs, then performance requirements, schedule, plus other aspects will suffer.
- Forced to spend dollars that could otherwise be used to improve vehicle performance and reliability. During last 2-3 years have spent $700K annually for pollution prevention program
- Have not had to pay any money out; all efforts been done within the SPO. Contractor has been doing work as a corporate entity therefore, costs have gone into overhead accounts

Contractual

- Every contractual action has required certification
- Actions held up till waivers were approved and mil-spec/stds were tailored
- all actions have required extensive reviews
- included pollution prevention requirements in RFP
- In 1985 the Government contracted with a prime contractor to design and develop a very complex system IAW military specs/standards which required the use of ODCs. We must now either live with them or pay to have them changed

Technology

- Studies will be required for subcontractors
- We have developed a robotic CO2 cleaning system to replace TCA in a cleaning process

Performance Requirements

- May be affected when Halon substitutes are identified
- Have improved in many cases because of quality and characteristics of substitutes ex. Using a commercial product (Simple Green) in the cleaning process on the radom

Schedule

Subcontracting

- We have had to ensure that lower tiered contractors/vendors have not made unilateral eliminations without prior notification. These changes could impact mission assurance

Manufacturing Processes

- Impacted because processes have had to change and new equipment has been purchased

Operations and Support

- Significant impact because system is operational
- Tech orders for operational use have been affected
- How to get Halon off the aircraft
- Have had difficulty in procuring ODCs even though a waiver has been approved. Have had to change some launch processing procedures to eliminate ODCs

General Comments

- All aspects have been or will be impacted. In the past the activity has been primarily analysis but in the future action will be taken to affect all aspects
- Program office included requirement in RFP for contractors to identify EPA 17 materials and conduct trade-off studies

No Impact

- Still in design phase
- Information system
- FMS program

SECTION 2 - IDENTIFICATION/CLASSIFICATION ISSUES

2-1. How could the uses of ODCs be categorized on your program? (Multiple choices may apply)

a. Cleaning Solvents
b. Fire Protection
c. Cooling
d. Painting/Depainting
e. Other

Cleaning Solvents: 14 total (70%): A/C - 9, Non A/C - 5
Fire Protection: 11 total (55%): A/C - 9, Non A/C - 2
Cooling: 7 total (35%): A/C - 4, Non A/C - 3
Painting/Depainting: 7 total (35%): A/C - 3, Non A/C - 4
Other: 1 total (5%): A/C - 0, Non A/C - 1
- used for thrust control (019)

None: 5 total (25%): A/C - 0, Non A/C - 5
- in design phase
- information system
- new program

2-2. The Clean Air Act contains the following definitions:

Mission Critical: Has a direct impact on the combat mission capability. Use is integral to combined mission assets or affects the operability of assets.

Mission Essential: Has an indirect effect on the mission and plays an auxiliary role in the operability of assets.

Nonessential: All other uses.

How has the use of ODCs on your program been classified (as defined by the Clean Air Act) with regard to the overall success of your program?

a. **Mission Critical**
b. **Mission Essential**
c. ***Nonessential***

Mission Critical: 10 total (50%): A/C - 6, Non A/C - 4
Mission Essential: 6 total (30%): A/C - 4, Non A/C - 2
Nonessential: 3 total (15%): A/C - 1, Non A/C - 2
Not applicable: 5 total (25%): A/C - 0, Non A/C - 5
Unknown: 1 total (5%): A/C - 1, Non A/C - 0

Mission Critical:

- Fire suppression/Halon (001, 002, 003, 007, 008, 010, 018),
- Waivers obtained for mission critical elements (004)
- due to combination of ODCs (3 primary)(012)
- because of air conditioning requirement (018)
- because of dispersant in the propellant (020
)

Mission Essential:

- spray lubes, solvents, cleaners (007)
- solvents in manufacture and support phases (010)

Nonessential:

- probably have but waiting for a baseline study to be completed
- All used in manufacturing or repair processes
- previously were classified as mission essential, but reclassified after substitutes were made

Not Applicable:

- in design phase
- information systems

Unknown:

- ODCs on program have never been previously classified

2-3. How are the ODCs on your program classified?

Class I
a. **Halons**
b. **Chloroflurocarbons (CFCs)**
c. **Carbon Tetrachloride**
d. **Methyl Chloroform**
e. **Methyl Bromide**

Class II
a. **Hydrochloroflurocarbons (HCFCs)**

Class I a. Halons: 11 total (55%): A/C - 9, Non A/C - 2
b. Chloroflurocarbons (CFCs): 13 total (65%): A/C - 8, Non A/C - 5
c. Carbon Tetrachloride: 5 total (25%): A/C - 3, Non A/C - 2
d. Methyl Chloroform: 7 total (35%): A/C - 4, Non A/C - 3
e. Methyl Bromide: 3 total (15%): A/C - 2, Non A/C - 1

Class II a. Hydrochloroflurocarbons (HCFCs): 3 total (15%): A/C - 2, Non A/C - 1
- some substitutes that have been made are HCFCs

Not Applicable: 5 total (25%): A/C - 0, Non A/C - 5
- in design phase
- information system

SECTION 3 - TECHNICAL DOCUMENTS (Technical Documents include but are not limited to MILSPECS, Standards, Technical Orders, and Program Specific Technical Documents)

3-1. Are you aware of any Air Force or DoD-wide cooperative efforts to screen technical documents (not including program specific documents), and if so, has your program benefited from these searches?

Aware: 18 total (90%): A/C - 10, Non A/C - 8
Not Aware: 2 total (10%): A/C - 0, Non A/C - 2

Have Benefited: 15 total (75%): A/C - 10, Non A/C - 5
Have Not Benefited: 5 total (25%): A/C - 0, Non A/C - 5

Aware of:

- ASC/EM efforts to screen
- AFMC specification database. Allows program office to match through spec tree
- AFMC ODC listing of Technical Orders
- AETC processed a class waiver which gave activities time to screen documents
- Contractor has also been doing their own independent screening because they are concerned that Government activities are inadequate
- SMC has cooperative process underway
- Cooperative AF/Navy database

Benefited:

- benefits have been very slow to be realized

Not Benefited:

- Information System
- Have tried to do away with MIL Specs and standards and gone to best commercial practices/products. Did not call out any specs or standards which might have called out ODCs
- Already on contract and doesn't foresee that their program met the criteria which would require modification of specs and standards
- Aware of fragmented approaches to screen documents but not sure which are the strongest, most reliable products

3-2. What, if any, has been the level of involvement from your Program Office to support the searches referenced in question 3-1?

Involved: 9 total (45%): A/C - 6, Non A/C - 3
Not Involved: 11 total (55%): A/C 4, Non A/C - 7

Involved:

- Assisted ASC/EM in their screening process; specs/stds divided among SPOs, each took a portion and screened then fed data back to ASC/EM who made data available to all
- We provided feedback to ESC/EN on our efforts to validate suspected ODC requirements identified by the AFMC/ENX effort
- Participated in Product Area Committee on space and propulsion at SMC

Not Involved:

- Since we elected to sponsor our own research, we had little involvement with these efforts
- In dem/val phase
- Information system
- ODCs not an issue of program

3-3. What is the status within your Program Office of reviewing and revising program specific technical documents to eliminate the requirement for ODCs?

Effort Complete: 6 total (30%): A/C - 2, Non A/C - 4

Effort Ongoing:11 total (55%): A/C - 8, Non A/C - 3

Not an issue: 3 total (15%): A/C - 0, Non A/C - 3

Effort Complete:

- Program certified on 1 Apr 94 that it is ODC free (including 2 prime contractors)

Effort Ongoing:

- still reviewing Technical Orders; 2 prime contractors have been involved
- trying to get on contract to contract out review of program specific TOs
- processing spec change; trying to get the paperwork through the contractual milestones
- efforts are done on an "as-needed" basis as determined by trigger mods, ECPs, and new initiatives
- we have written an ECP to the prime contractor to screen, digitize, and remove ODC references and find drop-in or suitable subs or process changes. This effort is expected to be on contract in Aug 94 and scheduled to last 2 years
- have completed review of all digitized documents and now in process of tailoring them. Still reviewing non-digitized documents using a 4 person team within the SPO
- screening process still on-going but primarily involves efforts of using command and contractor
- have reviewed the System A- spec and currently reviewing the Subsystem (B&C) specs. Reviews are not automated and thus very slow. Also currently evaluating a proposal by the prime contractor assess ODC usage under the system safety program
- in process of issuing an RFP. Going through document to ensure no ODCs are called out. Put special provision in RFP stating that the Government is not requiring the use of any ODCs and in the event the contractor must do any development (primarily NDI), they may not use any ODCs

- Tremendous effort. Newer documents have been screened; older ones are still under review. TOs have been done by SPO, others have been joint effort by SPO and contractor
- All government requirements to the contractor have been reviewed. Alternatives are being tested to ensure that they will meet the intent of old spec. The specs will not be changed until there is a clear understanding of the change that might be made

Not an Issue:

- in design stage
- information system

3-4. What methods are being used to identify the requirement for ODCs in program specific technical documents?

Word Searches:

8 total (40%): A/C - 7, Non A/C - 1
- Word Searches on database

Contractor Involved:

4 total (20%): A/C - 3, Non A/C - 1

- Contractor developed database which will be delivered to PS on CD ROM
- Contractor will be tasked to develop digitized database which will allow the government to complete the screening process
- Contractor tasked to do the screening
- Encourage contractor to identify any instances that the government may have overlooked

User Involved:

1 total (5%): A/C - 1, Non A/C - 0

- User completing screening process

Manual Review done in SPO:

10 total (50%): A/C - 4, Non A/C - 6
- Manual review

3-5. Has a contractor participated in the exercise of identifying ODCs in technical documents and if so, was their involvement voluntary or required by the Government?

Contractor not involved: 9 total (45%): A/C - 2, Non A/C - 7
Contractor Involved: 11 total (55%): A/C - 8, Non A/C - 3

Involvement required by Government: 7 total (64%): A/C - 6, Non A/C - 1
Voluntary involvement: 4 total (36%): A/C - 2, Non A/C - 2

Contractor not involved:

- effort done in-house primarily assisted by CETA contractors

Contractor involved:

- SPO issued an RFP for a 2 step process. First step - contractor is responsible to identify ODCs in TOs; second step - actually make changes to documents
- contractor is not required by any task to search for ODCs unless the chemical is identified as a "Hazard" under the contracted system safety program requirements

3-6. What is the estimated cost incurred to date to complete this process and what costs are expected to be incurred in the future?

Costs paid to contractor	To Date	Expected Future Costs
	$187K	$125K
	600K	2-5M
	10 M	140M
	1.2 M	1 M
	4.9M	2M
	1.5M	17.5M
	0	2.5M
	5K	9M
	0	1.5M
	123K	5K
	1.9M	2.4M
	80K	0

3-7. How much time has been invested in this process and what is the amount of time projected to be required to complete this project?

Time invested	Time required to complete
1 man year	1 man year
1/2 man year	1/2 man year
2-3 man years	1 man year
3 man months	-
4 man months	3 man months
56 man months	-
2 man months	1 man year
1 man month	-
10 man years	-
12 man months	0
1/2 man month	0
1 man month	0
1 man year	0
10 man months	10 man months

3-8. Describe your efforts to coordinate the search for suitable substitutes of ODCs with other services, defense contractors, private industry, labs, Air Force Program Managers, etc.

Government Organizations:	Number of times cited
Receive information from AFMC:	2
Involved with Center Product Area Committees (PAC):	5
Receive information from ASC/EM: (ASC/EM has a Center of Environment Excellence Team to coordinate efforts of multiple organizations in area of HAZMAT elimination.)	6
Receive information from ESC/CE	1
Receive information from Government Labs:	5
Work with China Lake Naval Warfare Center	1
Involved with Wright Labs Halon Replacement program:	2
Receive information from other Government Agencies:	6
Navy study which addressed substitute for aircraft cooling system	1
Involved with other agencies who have sponsored SBIR contracts (Navy, SM-ALC)	1
Working with NASA to qualify substitutes	1
Participate in Environmental Working Group (consists of user, logistics agency, contractor, SPO and EM)	1
Scanning SBA's "On-Line" Bulletin Board which provides gateways to EPA's Bulletin Boards	2
Private/Industry Organizations	
Rely on information received by contractor:	3
Review private industry information	2
Using GIDEP's Urgent Data Requests for environmental information	1
Attend Industry-wide conferences	1
Participate in Industry-wide conferences	1

SECTION 4 - ALTERNATIVE MATERIAL/PROCESS TECHNOLOGY

4-1. Are you aware if any alternative material or processes have been identified that would allow for the elimination of ODCs on your program?

Yes: 15 total (75%): A/C - 10, Non A/C - 5
No: 5 total (25%): A/C - 2, Non A/C - 3
Not Applicable: 4 total (20%): A/C - 0, Non A/C - 4

(Note: subtotals do not total to 20; several programs indicated that for CFCs they were aware of substitutes while they were not aware of substitutes for Halon or coolants/refrigerants. Both responses were recorded)

Yes, aware of alternatives:

Replacements made or identified:

- by end of 1993, had eliminated 92% of ODCs (CFCs)
- substitutes have already been made - HFC 134A for CFC-12 and R-500, and Ecolink for CFC 113
- in the depot repair process we have substituted using soap and water in pressure washes for Trichlo.
- Through a Navy study, we have identified alternatives for R-114, as well as for electronics and metal parts cleaning
- Substitutes identified and changes made to accommodate substitutes for cleaners used in Ops and maintenance arena; substitute for Freon identified and contract change in process; contractor is clean in its manufacturing processes
- One of our prime contractors had 43 processes which required a change. They have conducted extensive research with input from other commercial entities and then distributed the results via an environmental consortium. On our program, 7-8 new substances have been introduced in the substitution process. Our second prime was faced with a similar situation where ODCs were incorporated in numerous processes. They have made substitutes but have introduced a greater number of new products in the substitution process
- We originally used thousands of ODCs on the program; 50% now have identified substitutes
- alternatives identified for CFCs used as cleaning solvents
- in process of testing and qualifying substitutes as solvents
- are aware of the water based cleaning solvents in lieu of CFCs
- Contractor is aware of substitutes for cleaning and degreasing processes

Projected Schedules for Replacements:

- Prime contractor, principal subs, and lower tier suppliers are working towards being ODC free by end of CY95; depot repair facilities working towards Aug 96 (due to TOs which must be identified and modified)
- Prime contractor has said all Class I ODCs will be removed from the production line by 31 Dec 94. The government team must still approve the identified replacements

Substitutes not yet made:

- even though substitutes are available, extensive testing must be done to ensure they will meet performance requirements. This takes time and money
- contractor is fearful of liability and warranty problems with substitutes
- Tyndall AFB has identified some good candidates for Halon 1211 replacement

- some concern because substitutes may contain EPA 17 elements and would only be considered as a temporary substitute

No, not aware of alternatives:

- have not found substitutes for all ODCs yet; each alternative must be evaluated on a case by case basis to ensure that the change does not impact mission assurance

Halon:
- search for Halon substitute on-going
- project that by year 2001, we will be ready to replace Halon

Coolants:
- Could replace freon with an HCFC but this would require changes to our system. Waiting on test results on substitutes from lab at Tyndall AFB
- still attempting to identify and test replacements for refrigerants

Not Applicable:

- in Dem/Val phase
- Information system

4-2. In your opinion are any alternative material or processes currently commercially available, and are they economically feasible?

Yes, commercially available: 13 total (65%): A/C - 8, Non A/C - 5
No, not commercially available: 0 total
Unsure: 3 total (15%): A/C - 2, Non A/C -1

Yes, economically feasible: 11 total (85%): A/C - 7, Non A/C - 4
No, not economically feasible: 2 total (15%): A/C - 1, Non A/C -1

Not applicable: 4 total (20%): A/C - 0, Non A/C - 4

Commercially Available:

- commercial alternatives available for CFCs
- commercial alternatives available in repair of avionics components, general purpose cleaners, mold releases and degreasing agents. Wide range of products such as inks, lubricants, cutting oils, plus other products have recently been substituted and while somewhat less effective, are ODC free
- in states where environmental laws are stricter than national laws, substitutes have already been made (CA, NJ, MA)
- still testing and qualifying for some processes

Unsure:

- substitutes not yet identified, still exploring alternatives

Economically Feasible:

- water based solvents are economically feasible (will cost $1M to make substitutions on a $500M production contract

Not Economically Feasible:

- while solutions may be commercially available, they are economically expensive
- alternatives may have been economically feasible in the design phase, but are not once you reach production/deployment
- While R-134a is commercially available for cooling requirements, to retrofit our system to accommodate at this point in our operational phase will cost $7.9M in development costs plus $350 per unit (times 20 units) to make the actual change

Not Applicable:

- in Dem/Val phase
- Information system

4-3. What type of testing, either internal or external, are you aware of that the alternatives have undergone and are the test results readily available to other organizations?

Source of Testing

- SPO: 1
- Contractor : 6
- Wright Lab or other government labs (China Lake, lab at Ogden AFB): 6
- Depot: 1
- Commercial entities: 3
- Other agencies
  - Navy : 2
  - EPA :1
- Unknown: 3

Results available

- results of contractor tests are regularly made available at environmental conferences
- may not be applicable to other programs

4-4. For the known alternatives, are you aware of the Ozone Depleting Potential (ODP) factor and is it less than that of the ODC currently being relied upon?

Yes, aware: 10 total (50%): A/C - 6, Non A/C - 4
No, Not aware: 4 total (20%): A/C - 4, Non A/C - 0
Not applicable: 6 total (30%): A/C - 0, Non A/C - 6

Yes, Lower: 10 total (100%): A/C - 6, Non A/C - 4
No, Not lower: 0 total

Yes, aware:

- all the alternatives that have been implemented to date have an ODP factor of zero
- ODP for R134a is zero; other substitutes have lower ODP factors, some are Class II ODCs which is viewed only as a temporary fix
- may have to use a toxic substitute for an ODC (contains some of the EPA 17 elements) ; seen only as a temporary fix while research is on-going

No, not aware:

- plan to determine as part of on-going research, this data not yet available
- have no idea

Not Applicable:

- in Dem/Val
- information system
- ODCs not an issue
- not planning to make any replacements (FMS)

4-5. Are you aware if any of the alternatives are classified as "Hydrochlorofluorcarbons"?

Alternatives are HCFCs: 5 total (25%): A/C - 2, Non A/C - 3
Alternatives are not HCFCs: 8 total (40%): A/C - 6, Non A/C - 2
Unknown: 2 total (10%): A/C - 2, Non A/C - 0
Not applicable: 5 total (25%): A/C - 0 , Non A/C - 5

Alternatives are HCFCs:

- One of the considered alternatives if HCFC-124, a Class II ODC. R-124 would cost less in system modifications but because of its higher political risk, we are leaning towards R-134a as a substitute
- two alternatives for freon (R-12 and R-22) are classified as HCFCs
- although we are using an HCFC as a substitute, our weapon system will be phased out of the inventory before the production ban on HCFCs goes into effect. We are trying to balance reality with what would be the best long-term solution

Alternatives are not HCFCs:

- None are at this time however, they can not be ruled out in the future as substitutes as we define the full range of our ODC uses

Unknown:

- Contractor is doing all the substitution exploration; however, we are trying to avoid using HCFCs as substitutes

Not applicable:

- ODC replacement is not an issue

4-6. Have substitutions to ODC processes/materials been made on your program? If so, did the alternatives affect any of the following aspects of your program, and if so, how? Please rank, from greatest to least, the impact to the different aspects.

a. Financial
b. Performance Requirements
c. Contractual
d. Schedule
e. Warranties
f. Subcontracting
g. Manufacturing Processes
h. Operations and Support

Impacted: 8 total (40%): A/C - 5, Non A/C - 3
No Impact: 7 total (35%): A/C - 5, Non A/C - 2
Not Applicable: 5 total (25%): A/C - 0, Non A/C - 5

Financial	ranked	#1 by 4 programs (A/C - 2, Non A/C - 2) #2 by 1 program (A/C - 1, Non A/C - 0) #3 by 0 programs (A/C - 0, Non A/C - 0)
Performance Requirements	ranked	#1 by 1 program (A/C - 0, Non A/C - 1) #2 by 1 program (A/C - 1, Non A/C - 0) #3 by 0 programs (A/C - 0, Non A/C - 0)
Contractual	ranked	#1 by 1 programs (A/C - 1, Non A/C - 0) #2 by 2 programs (A/C - 0, Non A/C - 2) #3 by 1 program (A/C - 1, Non A/C - 0)
Operations and Support	ranked	#1 by 1 programs (A/C - 1, Non A/C - 0) #2 by 1 program (A/C - 1, Non A/C - 0) #3 by 1 programs (A/C - 1, Non A/C - 0)
Manufacturing Processes	ranked	#1 by 1 program (A/C - 1, Non A/C - 0) #2 by 1 program (A/C - 0, Non A/C - 1) #3 by 0 programs (A/C - 0, Non A/C - 0)

Ranked	#1	Financial	4 programs (A/C - 2, Non A/C - 2)
		Performance Requirements	1 program (A/C - 0, Non A./C - 1)
		Contractual	1 program (A/C - 1, Non A/C - 0)
		Manufacturing Processes	1 program (A/C - 1, Non A/C - 0)
		Operations & Support	1 program (A/C - 1, Non A/C - 0)
	#2	Contractual	2 programs (A/C - 0, Non A/C - 2)
		Financial	1 program (A/C - 1, Non A/C - 0)
		Performance Requirements	1 program (A/C - 1, Non A/C - 0)
		Schedule	1 program (A/C - 1, Non A/C - 0)
		Manufacturing Processes	1 program(A/C - 0, Non A/C - 1)
		Operations and Support	1 program(A/C - 1, Non A/C - 0)
	#3	Contractual	1 program (A/C - 1, Non A/C - 0)
		Warranties	1 program (A/C - 0, Non A/C - 1)
		Subcontracting	1 program (A/C - 0, Non A/C - 1)
		Operations and Support	1 program (A/C - 1, Non A/C - 0)

Impacted:

- Impact was minimal; all substitutes were either "drop in" or required very little changeover costs
- impact has been minimal because we are still early in the design phase

No Impact:

- Too early to judge what the impacts will be
- No substitutes have yet been made
- Contractor has made many substitutions but we have not seen any direct impact on our program
- Some substitutes have been made; however we have suffered few if any adverse effects due to the limited number of subs and the fact that we still rely on waivers for those areas in which we do not yet have an effective sub or new process
- The contractor has made changes where they were not bound by requirements to use the substance. Nothing has been affected by this change

Not Applicable:

- substitutes for ODCs is not an issue

4-7. Are you aware if any of the following organizations have approved alternative materials or processes for uses similar to those for which your program may be using ODCs? Please explain.

a. Environmental Protection Agency (EPA)
b. other organizations within the Department of Defense
c. other Air Force programs offices
d. any of the DoD labs
e. other (commercial or defense contractors, industry labs, associations/societies)

Environmental Protection Agency (EPA): 6 total (30%): A/C - 3, Non A/C - 3
other organizations within the Department of Defense: 7 total (35%): A/C - 3, Non A/C - 4
other Air Force programs offices: 4 total (20%): A/C - 2, Non A/C - 2
any of the DoD labs: 4 total (20%): A/C - 2, Non A/C - 2
other (commercial or defense contractors, industry labs, associations/societies): 2 total (10%): A/C - 1, Non A/C - 1
unaware: 4 total (20%): A/C - 3, Non A/C - 1
Not applicable: 5 total (25%): A/C - 0, Non A/C - 5

Environmental Protection Agency (EPA):

- aware of the EPA "SNAP" listing of substitutes
- keep up with EPA info, however just because EPA approves does not mean the AF will approve as a substitute or that it will work on a particular program

other organizations within the Department of Defense:

- ASC/EM
- ESC/CE relays information to our program office
- AFMC/EN
- NASA and AGMC provide data to us which we evaluate on a case specific basis
- we rely on information from the Navy since we have a joint program

other Air Force programs offices:

- Information being related through PAC interchanges

any of the DoD labs:

- Wright labs for Halon 1301 substitute, Tyndall AFB for Halon 1211 substitute .

other (commercial or defense contractors, industry labs, associations/societies):
- we receive information from the Navy's labs

Unaware:

- Contractor has been heading up the substitution process without direct involvement of the SPO

Not Applicable:

- ODC substitution not an issue

General Comments:

- We are aware and have volumes of data on alternatives from all sources listed above. However before we can begin the process we must baseline the extent of our ODC usage, then prioritize, fund, and implement
-We can not make any T.O. changes until any substitute has been tested on our airplane because not all substitute will work in every situation. For example, the plastic bead blasting for paint removal cannot be used on any aircraft with a Boeing 707 fuselage - this eliminates AWACS, Joint STARS, KC-135

4-8. Is your Program Office pursuing any research and development efforts to discover substitutes for ODCs used on your program? If the answer is yes, do the R&D efforts involve any of the following?

a. Other Program Offices
b. Contractors
c. Government labs
d. Other

Yes: 11 Total (55%): A/C - 7, Non A/C - 4
Other Program Offices: 1 total (5%): A/C - 1, Non A/C - 0
Contractors: 6 total (30%): A/C - 4, Non A/C - 2
Government labs: 8 total (40%): A/C - 6, Non A/C - 2
Other: 1 total (5%): A/C - 0, Non A/C - 1
No: 4 total (20%): A/C - 3, Non A/C - 1
Not Applicable: 5 total (25%): A/C - 0, Non A/C - 5

Yes:
Other Program Offices:

- via the multiple PACs that we are members of

Contractors:

- through our prime contractor

Government labs:

- Wright labs for Halon substitute
- working with the Navy lab at China Lake

Other:

- NASA is conducting research for our program

No:

- we are not working directly with any organizations because it is an Air Force wide problem but will await their results (Wright lab) before making any substitutes
- we do not have any funds to allocate to R&D efforts

Not Applicable:

- ODC substitute not an issue

4-9. Are you aware of any Air Force or DoD-wide efforts to coordinate the search for suitable ODC substitutes with the other services, defense contractors, and/or private industry and, if so, have you benefited from these searches?

Not Aware of: 0 total
Aware of: 16 total (80%): A/C - 10, Non A/C - 5

with: Product Area Committees (PAC)
ASC/EM
ESC Pollution Prevention Offices
Wright Labs
Tyndall AFB labs
AF Center for Environmental Excellence
AFMC
San Antonio Logistics Center
Navy
GIDEP
Cooperative arrangements among DoD and private industry

ODC Substitutes not an issue: 5 total (25%): A/C - 0, Non A/C - 5

No Benefit: 8 total (50%): A/C - 4, Non A/C - 4
Have Benefited: 8 total (50%): A/C - 6, Non A/C - 2

- have benefited from the information contained on the data bases at the AF Center for Environmental Excellence, AFMC, and the San Antonio Logistics Center
- benefits received from the coordinated effort that ESC/EM provides; they have published a suggested substitution list which narrowed down our own individual search
- we are aware of many different sources and benefit to some extent from them all, however, there appears to be a great deal of duplication among the different organizations. Our job would be much easier if there were one centralized source within the DoD whom we could turn to for up-to date information

No Benefit:

- just recently started the interchange with the PAC; too early yet to state that benefits have been received
- are keeping abreast of developments on a Navy and Sacramento ALC SBIR contract; too early to derive benefit but we expect benefits in the future. Subjects are electrochemical striping of aircraft coatings; development of non-chromate coatings for aluminum and magnesium in aircraft applications; and non-isocyanate based polyurethane paints
- we are aware of coordinated efforts through our PAC interchanges but we do not have a great deal of visibility as to the total scope of these efforts

SECTION 5 - REPORTING AND SUPPLY ISSUES

5-1. Have you been informed by current suppliers or contractors that either they will no longer be able to supply particular ODCs or that the cost of supplying ODCs will be substantially higher?

Yes: 8 total (40%): A/C - 4, Non A/C - 4
No: 6 total (30%): A/C - 6, Non A/C - 0
ODCs not an issue: 6 total (30%): A/C - 0, Non A/C - 6

Yes:

- Northrop is starting to see interruptions but has not yet impacted our program
- We have been informed that the supply of Halon will soon become a problem
- We know that the production of Halon was phased out 1 Jan 94 and the remaining Class I ODCs will be phased out 31 Dec 95. Therefore, we are scrambling to remove reliance on these materials
- The Navy E-2C study brought to our attention that F-114 is produced by only four manufacturers in the U.S. The first, Dupont, will phase out production of R-114 in Dec 94; the other three (Allied Signal, Atochem, and Laroche) will be phasing out production of R-114 in Dec 95 by federal mandate
- Due to state laws, certain chemicals can no longer be used. It has been difficult to assess the cost but with the draw down, overheads go up
- told by Hughes that they would be running our of Halon in Saudi Arabia
- have been told that supply would diminish and cost would increase for both CFCs and Freon

ODCs not an issue:

- in Dem/Val
- all substitutes have previously been made
- information system
- program specified no ODCs allowed

5-2. If substitutes are not available or are not economically feasible, what is the long term plan to supply ODCs for your program?

DLA ODC Bank: 5 total (25%): A/C - 5, Non A/C - 0
Relying on AF stockpile for Halon 1301: 1 total (5%): A/C - 1, Non A/C - 0
Relying on program supplies: 2 total (10%): A/C - 1, Non A/C - 1
Long term plan not required: 12 total (60%): A/C - 3, Non A/C - 9

Comments:

DLA ODC Bank:

- The E-3A program plans to go to the DLA bank for Halons; however the Japanese AWACS is considered a commercial buy by Boeing and it has stockpiles enough Halon 1211 and 1301 to last to the year 2020
- Only projecting that a long term plan will be required through the flight test program; we anticipate that 72 lbs of Halon will be required and this has been coordinated with the DLA ODC bank. After that, we project that a substitute for Halon will have been introduced to our system and ODCs will not be an issue
- We have estimated our mission critical life cycle ODC needs and reported them to AFMC in response to the DLA ODC data call

Relying on AF stockpile for Halon 1301:

- The Air Force currently maintains large stocks of Halon 1301 so this should not be a problem

Relying on program supplies:

- We have only run into this problem with Halon 1301. Because of this lack of availability, we have removed and banked all supplies of this material. It will only be used in a combat situation
- The program is considering applying for an Essential Use Exemption to the Montreal Protocol or will stockpile and use the coupon measure in the Clean Air Act to obtain new ODCs

- **Long term plan not required**

  - ODC substitution not an issue
  - plan to identify alternatives for all ODCs prior to the time they are phased out of production
  - substitutes have already been made
  - since this is an FMS program, project that the Saudis would have to support the system when availability becomes an issue; our initial support ends in January 96
  - plan to phase out the program before supply becomes an issue
  - We plan to use commercial resources as long as they are available which should be through the program's life cycle

5-3. If ODCs have not been eliminated from your program, what methodology is being used to project the expected ODC requirements for the Program's life cycle?

Internal Program/engineering estimates: 7 total (35%): A./C - 6, Non A/C -1
Contractor projections: 1 total (5%): A/C - 1, Non A/C - 0
AF Metric: 2 total (10%): A/C - 1, Non A/C - 1
No method used to date: 3 total (15%): A/C - 2, Non A/C - 1
ODC elimination not an issue: 8 total (40%): A/C - 1, Non A/C - 7

Note: one program indicated they used both internal program estimates and the AF Metric

No method used to date:

- Struggling with this requirement. Told to use past consumption rates but those are not really valid indicators of future usage; therefore we are not quite sure how to estimate
- waiting for the Saudis to generate this data

5-4. If the use of an ODC has been classified as "Mission Critical" to the performance of your system, are you planning to obtain supplies from the Defense Reserve (ODC Bank) managed by the Defense Logistics Agency (DLA)?

Yes: 5 total (25%): A/C - 5, Non A/C - 1
No: 4 total (20%): A/C - 1, Non A/C - 3
Not applicable: 10 total (50%): A/C - 4, Non A/C - 6

5-5. Are you planning to turn in any excess ODCs to the Defense Reserve?

Yes: 4 total (20%): A/C - 3, Non A/C - 1
No: 8 total (40%): A/C - 5 total, Non A/C - 3
Unknown: 2 total (10%): A/C - 1, Non A/C - 1
Not Applicable: 6 total (30%): A/C - 1, Non A/C - 5

5-6. Is the shelf-life of the ODCs an issue with the supply or projected availability and if so what are the contingency plans?

No: 12 total (60%): A/C - 9, Non A/C - 3
Yes: 3 total (15%): A/C - 1, Non A/C - 2
Contingency Plan:
- none at the present (010, 019)
- shelf life is a concern and presently a study is underway to examine this issue and define potential concerns (020)

Not Applicable: 5 total (25%): A/C - 0, Non A/C - 5

5-7. Is there a particular metric being used within your Program Office to track the ODC requirements?

SAF/AQ: 16 total (80%): A/C - 10, Non A/C - 6
(is reported up through AFMC per AQ Policy 93M-011)
Program specific metric: 1 total (5%): A/C - 0, Non A/C - 1 (this is in addition to the SAF/AQ metric)
Not applicable: 4 total (20%): A/C - 0, Non A/C - 4

Comments:

- contractor has been tracking ODC usage on their own since 1988
- although we are using the SAF/AQ metric it does not give us visibility into the specific ODCs and therefore is of little use in managing our ODC program; have also developed an in-house metric to give us the information that we specifically need

5-8. What, if any, reporting mechanism is currently in place to report to higher levels of management on the projected ODC requirements, and how often is that information processed?

Waiver support information: 2 total (10%): A/C - 2, Non A/C - 0
AFMC periodic request : 5 total (25%): A/C - 4, Non A/C - 1
None other than SAF/AQ report : 8 total (40%): A/C - 3, Non A/C - 5
Information presented at the WSPAR briefings : 2 total (10%): A./C - 2, Non A/C - 0
Not applicable: 4 total (20%): A/C - 0, Non A/C - 4

* 1 program reported multiple responses

SECTION 6 - DEMOGRAPHIC INFORMATION

6-3. Desc be the sources from which you have received information on the ODC issue. (Multiple choices may apply)

a. Official briefings: 16 total (80%): A/C - 9, Non A/C - 7
b. Formal courses: 5 total (25%): A/C - 3, Non A/C - 2
c. Official correspondence: 20 total (100%): A/C - 10, Non A/C - 10
d. AFMC video: 8 total (40%): A/C - 6, Non A/C - 2
e. Personal reading: 14 total (70%): A/C - 8, Non A/C - 6
f. Other: 4 total (20%): A/C - 3, Non A/C - 1

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Ms Willard's acquisition experience includes six years as a Contract Negotiator at Electronic Systems Center, Hanscom Air Force Base, Massachusetts and three years as a Procurement Analyst with Aeronautical Systems Center, Wright-Patterson Air Force Base, Ohio. Ms Willard was admitted to the Graduate School of Logistics and Acquisition Management, Air Force Institute of Technology, in May 1993. Upon completion of the AFIT Graduate Program, Ms Willard will be re-assigned to a contracting position at Aeronautical Systems Center.

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13. ABSTRACT *(Maximum 200 words)*

This research was undertaken to determine how effectively the Air Force had eliminated its dependence on Ozone Depleting Chemicals. The research was limited to analyzing the impact of ODCs on major acquisition programs. Results indicated existing variables which may be impeding full implementation. Also identified were lessons learned which could be applied to future environmental legislation with potential impact on acquisition programs. In-depth telephonic interviews were conducted with Program Directors responsible for the development and fielding of major Air Force acquisition programs. Analysis revealed that ODCs substantially impacted the acquisition programs to the extent that many programs had classified their reliance on the chemicals as "Mission Critical". Although great strides had been made in the private sector to identify alternatives to ODCs, Program Directors, in many cases and for numerous reasons, had not made the substitutions on their programs. Program Directors have diligently been applying resources to solve their specific ODC problems, but unless greater cross-flow of information and cooperation among Air Force programs, DoD organizations, and the private sector takes place, progress will be impacted. Future environmental initiatives could be more effectively implemented by the development and implementation of an overall coordinated, strategic approach.

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